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SHAMEFUL ABANDONMENT OF IMPORTANT LIGHTS.

As far as the great lakes are concerned, the United States lighthouse board is under the general indictment of inefficiency. As to what the inefficiency consists of, an inkling may be gained by reading the communication of Capt. Alexander McDougall in another column. Why should a department of the federal government abandon its work right at the very time that it is most needed? The taking up of buoys, floats and other aids to navigation in connecting rivers of the lakes while two-thirds of the fleet is still in commission, which is done every fall, is even less excusable. The claim of the inspectors that they lack facilities for the work is a poor excuse, in view of the fact that the lighthouse board with the appropriations available, seems to take about three years to build an ordinary small vessel of the tender kind. It is shameful to admit that they do these things much better in Canada. Canadian lights are maintained until later in the season than American lights and at points, too, that are probably not as important. In the annual report of the Lake Carriers' association for 1901 the following passage occurs:

"Attention should be called once more to the early closing of some of the important light stations of the government on the great lakes. The officers of the association had this matter up with the lighthouse board in connection with the closing of the Passage island light station. Public announcement was made in November that this station would close on Nov. 25. As soon as this announcement was made the Lake Carriers' association requested the lighthouse board to keep the station in operation until the close of navigation. Considerable correspondence with the board and with Com'dr Wilson, inspector of the eleventh lighthouse district, followed, with the following result: The board reported that they were unable to keep the station open any later than the date advertised for closing, unless the Lake Carriers' association would make a clear guarantee to remove the keepers from the station, and that the guarantee should be of such a character that there would be no doubt of our ability to carry it into effect. At a meeting of the executive committee, held in Cleveland, it was decided that the association was not in position to make such a guarantee. It appeared that a matter of life and death of the keepers was involved, as they were not provided with fuel and rations sufficient to permit them to remain on the island for the winter in case their removal at the close of winter was rendered impossible by weather conditions. The association then urged upon the lighthouse board

that in future it would modify its arrangements at this station and others similarly situated, so that rations and fuel might be provided for the keepers, the lights kept open until the close of navigation and the keepers then removed, if possible; otherwise, if the removal of the keepers proved impossible, they could remain on their stations during the winter. We are happy to state that the board considers this proposal a reasonable one and has assured the association that it will take up the question of keeping Passage island light in operation until navigation is closed on account of ice, and will make before the close of another season suitable arrangements whereby this can be accomplished."

Alas, that the inevitable result of fire should be ashes. The lighthouse board did nothing of the kind. It may have taken the subject under consideration but, if it did, it is considering it yet. Certainly the lighthouse board pursues its affairs with infinite deliberation. One of its most exasperating characteristics is to acknowledge your communications. After one has waited a fitting time for a reply, the reply, indeed, comes but it contains only the blissful information that your communication has been received. This

is a method most irritating to the flesh, especially if one is tearing the envelope open with great eagerness to get at the subject matter of his inquiry.

During 1902 the committee on aids to navigation of the Lake Carriers' association again called the attention of the lighthouse board to the fact that the aids to navigation on Stannard rock, Manitou island, Passage island, Outer island, Devil's island and Sand island, Lake Superior, are extinguished before the season of navigation is quite over. "If the lights are needed at all on these islands," said the committee in its report, "they are needed most when navigation is attended with its highest perils; but to this necessary and reasonable request the lighthouse board has paid no attention whatever that we are aware of."

The committee suggested to the board that the lamps be charged with Pintsch gas to burn continuously for two or three weeks after the keepers have withdrawn from the islands. To this the board replied that such a course would, of necessity, leave the lenses exposed all winter and it was feared that the sun's rays and atmospheric conditions might work an injury to them. The keepers usually draw a hood over the lenses when they leave. Whether or not the sun's rays would affect the lenses is not known. The lighthouse board does not know it but promised to



Steamer John T. Hutchinson passing through the Sault Ste. Marie Canal, the last vessel to be locked through during the Season of 1903.

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conduct an experiment at Windmill point to determine the matter. The experiment was not made. And thus the matter hangs.

The point which Capt. McDougall makes is exceedingly well taken—that it is sufficient to make the blood boil to see the light-house keeper on dress parade on a public street while the master of a vessel is out in the lake with his crew, at his wit's end, endeavoring to discover his position and fearing every moment that he will run his craft upon some hidden danger for want of the customary beacon. The government should adopt some means of keeping these lights burning until after the close of navigation.

A CRIPPLE MAKING THE LAST TRIP OF THE SEASON.

The steamer John T. Hutchinson, which ran on the rocks off Eagle river, Lake Superior, was the last steamer to pass through the American lock at Sault Ste. Marie. The illustration on the first page shows how she looked as she passed through the lock and on this page are some more striking views show-



The Steamer Hutchinson as She Looked when She Entered the Detroit River.

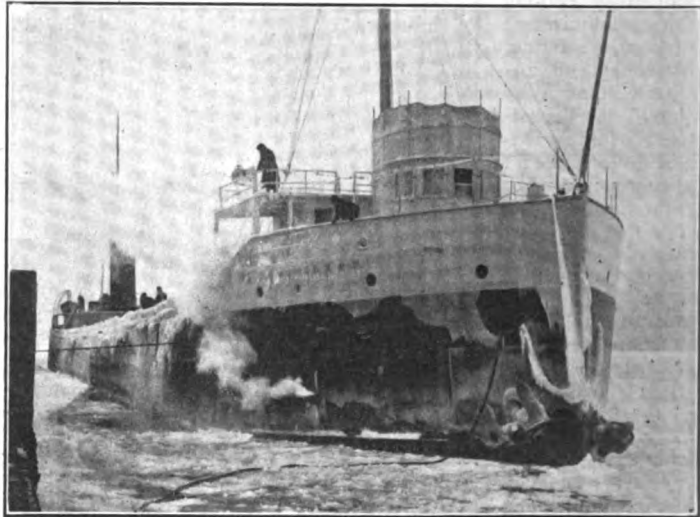
ing how she looked after she had passed through Lake Huron and had got into the Detroit river. Truly she might be called the phantom ship of the lakes. Ice and snow covered her from her water line to half way up her spars. She was drawing 20 ft. aft as she came down the lakes and the lighter Newman was summoned to meet her at Sandwich to take off part of her flax cargo, so that she could pass the Lime-Kiln crossing, which is now the shallowest section of the rivers. The Hutchinson tied up at the Pittsburg Coal Co.'s dock at Sandwich for the purpose of being lightered. As soon as the process of lightering began it was found that the pressure was being lifted from the tank tops and that the water was coming in faster than the flax was going out. Two extra pumps had to be placed aboard to keep the steamer from sinking at the dock. All the compartments of the water bottom filled and there was 18 ft. of water in the fore-peak. The pumps worked all Tuesday night in an endeavor to get the steamer away on Wednesday. They were not successful in this, however, and it was a debatable subject on Thursday morning whether she could force her way through the ice at the head of Lake Erie.

LAKE SHIP YARD MATTERS.

When Capt. A. B. Wolvin built a freighter of the kind that has only 12 ft. between centers of hatches that are themselves 9 ft. fore and aft and almost the entire width of the ship, he startled the vessel owners generally and the classification societies in particular. Of course the object of this great number (twenty-four in a 415-ft. vessel) of open spaces from deck into hold is to facilitate the unloading of ore by automatic machines. That the departure had its advantages and has commended itself commercially to the ship owner is shown by orders since given for several similar vessels and by the loading and unloading records of the James H. Hoyt, which has been loaded in one hour and unloaded in three hours and forty-five minutes. Now Capt. Charles L. Hutchinson of Cleveland has just given an order to the American Ship Building Co. for a big freighter and she is to have hatches spaced 12 ft. centers. The new steamer will be 436 ft. over all, 416 ft. keel, 50 ft. beam and 28 ft. deep. She will have triple-expansion engines with cylinders of 22, 35 and 58 in. diameter by stroke of 40 in., supplied with steam from two Scotch boilers, 13 ft. 9 in. in diameter and 11½ ft. long, fitted with Ellis & Eaves draft. The steamer will have twenty-four hatches and will have a carrying capacity of 6,200 tons on 18 ft. draught. In all respects, save hatches, she will be similar to the fleet of eight duplicate steamers built for the Gilchrist Transportation Co. This makes the third order which the American Ship Building Co. has received for steamers during the past two weeks. The large steel freighter announced just previous to the Hutchinson boat is for the Mack fleet of Cleveland.

At a meeting of the Cleveland & Buffalo Transit Co., held in Cleveland on Tuesday, it was decided to lengthen the steamer

City of Buffalo 42 ft. and to give her 2 ft. more beam. It is estimated that the change will increase her freight and passenger capacity about 60 per cent. When the change is made she will be 350 ft. keel and 78 ft. beam which will make her 26 ft. longer than the City of Erie and of about the same size as the Eastern States and Western States. No change will be made in her engines, which are duplicates of the City of Erie and considered ample for the larger hull. On the famous run with the Tashmoo the Erie generated a horse power of 6,800 though only 3,500 is normally used. Mr. Frank E. Kirby, who designed the steamer and under whose direction the changes will be made at the yard of the Detroit Ship Building Co., says that the addition will result in no diminution in her speed. The lengthening of the steamer will permit the addition of 100 staterooms and four parlors with bath. A new lighting plant will be installed, which, with the present plant as an auxiliary, will furnish power for 2,000 lamps. The work of reconstruction will begin at once, so that the steamer will be ready for service when navigation opens in the spring. The



company will not now purchase the steamer Harlem, upon which an option was secured last fall.

On Saturday last the steamer Edwin F. Holmes was launched at the Lorain yard of the American Ship Building Co. for the Bransford Transit Co. Miss A. E. Hawgood, daughter of Mr. W. A. Hawgood, named the vessel. The new steamer is 440 ft. over all, 420 ft. keel, 50 ft. beam and 28 ft. deep. She will have triple expansion engines with cylinders of 22, 35 and 58 in. diameter by stroke of 40 in. and will be supplied with steam from two Scotch boilers, 13½ ft. in diameter and 12 ft. long, fitted with Ellis & Eaves draft. She is promised by the opening of navigation next season and will be commanded by Capt. James Owen. The Holmes will be managed in the office of W. A. and Arthur H. Hawgood.

MANAGEMENT OF STEEL CORPORATION VESSELS.

No one knows whether Mr. Harry Coulby will take the general management of the Pittsburg Steamship Co. or not, from which it is quite natural to draw the conclusion that he does not know himself. He has been extremely non-committal and appears as one who is debating the matter with himself. The sacrifice of his present relations with Pickands, Mather & Co. is what causes him to hesitate. However, if he does take the position he will probably also assume the duties of president of the company. This would be quite in line with the policy of retrenchment lately inaugurated by the Steel Corporation. Mr. D. M. Clemson has resigned as president of the Pittsburg Steamship Co. and his resignation takes effect with Mr. Wolvin's on Jan. 1. Various other changes are to be made in the personnel of the Corporation at the first of the year, notably among them being George E. McCagne, chairman of the traffic managers' committee and traffic manager of the Carnegie Steel Co., and Charles B. Murray, one of the chemists of the Carnegie Steel Co. and formerly chief chemist of the Edgar Thompson Steel Works. Both of these gentlemen have resigned. It is understood that within the past few weeks Mr. Frick has taken a very active interest in affairs of the big organization, and of course the general inference is that he has Rockefeller backing, as in Steel Corporation matters he has been very close to the founder of Standard Oil.

The project to provide a harbor of refuge at Point aux Barques will be dropped, Capt. L. H. Beach having reported that the locality is not worth the improvement. He learned from vessel men that they would not use the harbor if made, owing to the rocky coast and to the fact that Sand Beach harbor is only 25 miles from that point.

Assistant United States Engineer B. A. Marr of Houghton is endeavoring to locate for chart purpose the rock on which the big steel steamer Hutchinson was stranded recently near Eagle river, Lake Superior.

IRON ORE SHIPMENTS BY LAKE.

Vessels Transported 23,649,550 Gross Tons During the Season just Closed, a loss of 3,389,619 Tons Compared with Shipment Last Year.

Final returns regarding iron ore shipments by lake for 1903 show an aggregate of 23,649,550 gross tons. This does not include 203,419 tons shipped from the Lake Superior Consolidated mines on the Michipicoten range in Canada. Neither does it include the shipments by rail to furnaces near the mines, which are estimated at about 450,000 tons. With these two items added the grand total will be well over 24,000,000 tons. The grand total of shipments during 1902 was 27,571,121 tons, of which 27,030,169 tons was by lake; therefore the lake shipments this year are 3,389,619 tons less than they were last year. Various causes contributed to this, the principal one being that more ore was brought down last year than was needed and the surplus had to be added to the available supply for consumption this year. Of the 203,419 tons shipped from the Michipicoten range 170,672 tons went to Lake Erie ports.

It will be noted that no port shows a gain over the shipments of last year. Every port shows a loss, the most severe one being at Escanaba, where the shortage is 1,136,143 tons. Shipments from all upper lake ports for the past five years are shown in the following table:

	1903.	1902.	1901.	1900.	1899.
Escanaba	4,277,501	5,413,704	4,022,968	3,436,734	3,720,218
Marquette	2,007,346	2,395,010	2,354,284	2,061,861	2,733,596
Ashland	2,823,119	3,353,919	2,896,252	2,633,687	2,703,447
Two Harbors	5,120,656	5,005,185	5,018,197	4,007,294	3,973,733
Gladstone	85,816	92,375	117,089	418,854	381,457
Superior	3,958,579	4,180,798	2,321,077	1,522,899	878,942
Duluth	5,336,173	5,598,408	3,437,955	3,888,986	3,509,965
Total, by lake	23,649,550	27,030,169	20,157,522	18,570,315	17,901,358
Total, all rail		531,952	431,715	489,078	350,446
Total shipments		27,571,121	20,589,237	19,059,393	18,251,804

FULL REPORT FROM SAULT CANALS.

Of course the traffic to and from Lake Superior through the canals at Sault Ste. Marie shows a decrease for the past season in common with all other branches of lake trade. There was moved through the canals in 1903 a total of 34,674,437 net tons of freight, compared with 35,961,146 tons in 1902, or a decrease of 1,286,709 tons. A full summary of the traffic of both canals, Canadian and United States, for three years past follows:

COMPARATIVE STATEMENT OF LAKE COMMERCE THROUGH CANALS AT SAULT STE. MARIE, MICHIGAN AND ONTARIO, FOR THE SEASONS OF 1901, 1902 AND 1903.

ITEMS.	SEASONS.		
	1901.	1902.	1903.
Vessels:			
Steamers	Number 14,372	17,069	14,028
Sailing	Number 4,482	4,268	3,769
Unregistered	Number 1,187	1,222	1,001
Passages	Number 20,041	22,659	18,598
Lockages	Number 11,321	12,846	11,644
Tonnage:			
Registered	Net tons 24,626,976	31,955,582	27,736,466
Freight	Net tons 28,403,065	35,961,146	34,674,437
Passengers	Number 59,663	59,377	55,175
Coal:			
Hard	Net tons 804,498	369,948	1,149,005
Soft	Net tons 3,788,643	4,502,530	5,788,628
Flour	Barrels 7,634,350	8,910,240	7,093,380
Wheat	Bushels 52,812,636	76,730,965	61,384,552
Grain (other than wheat)	Bushels 24,760,547	27,740,822	32,095,646
Manufactured and pig iron	Net tons 206,443	198,152	281,307
Salt	Barrels 443,774	443,306	454,882
Copper	Net tons 98,601	120,612	112,877
Iron ore	Net tons 18,000,618	24,277,555	21,654,898
Lumber	M. ft B M. 1,072,124	1,091,471	1,003,192
Silver ore			
Building stone	Net tons 46,584	38,919	21,300
General merchandise	Net tons 558,041	740,100	659,839

The Canadian canal closed Sunday, Dec. 13, and the American canal Tuesday, Dec. 15.

LIGHT STOCKS OF WHEAT.

Duluth, Minn., Dec. 16.—Wheat receipts are very small, and bid fair to continue so for some time. Stocks are only 1,217,000 bu. and this all belongs to eastern mills or to those who are holding for a rise. Local mills are forced to buy from hand to mouth, and will soon be obliged to get their stocks out of store.

Flax stocks are now increasing quite rapidly and amount to 4,490,000 bu., an addition of 681,341 bu. this week. This compares with an increase of 490,323 bu. the corresponding week last year. Receipts of flax for the crop year are only about 600,000 bu. behind those of the same period last year, which was the record breaker. The steamer Sinoloa of the Tomlinson fleet is carrying a cargo of flax of 246,875 bu. over winter in this harbor.

IRON ORE ON LAKE ERIE DOCKS.

In view of the general slump in the iron and steel industry, the summary of stocks of ore on Lake Erie docks is not as discouraging as was expected. Of course the reduction of more than 3,000,000 tons (gross tons in all cases) in the output of Lake Superior mines this year as compared with 1902 has been a great factor in keeping down the Lake Erie dock stocks. Reports to the Marine Review from all Lake Erie docks show that of the total output of 23,649,550 tons of ore by lake they received 19,681,731 tons and had a balance on dock Dec. 1 of 6,371,085 tons. In 1902 they received 22,649,424 tons and held a balance Dec. 1 of that year of 7,074,254 tons. There are no definite figures as to stocks of ore at the furnaces but the aggregate of furnace supplies on hand is undoubtedly as large as it has ever been, so that a large surplus, both at furnaces and Lake Erie docks, must be looked for next spring in the absence of decided improvement in the iron business.

Of course there is a falling off also in the shipments to furnaces during the navigation season just closed. Shipments to furnaces between May 1 and Dec. 1 of this year aggregate 16,903,013 tons compared with 18,423,364 tons in 1902, 14,204,506 tons in 1901, 11,613,773 tons in 1900 and 11,765,158 tons in 1899.

The shipments to furnaces during the navigation season above referred to are determined in this way: First we have the amount of ore on Lake Erie docks before the opening of navigation on May 1, last, 3,502,367 tons; add to this the receipts of the season just closed, 19,681,731 tons, and the total is 23,274,098 tons; deduct the amount now on dock, 6,371,085 tons, and we have 16,903,013 tons as the amount that was forwarded, either direct or from dock, to the furnace yards.

It is understood, of course, that the difference between the output of 23,649,550 tons from the mines and the receipts of 19,681,731 tons at Lake Erie ports, is ore that went to places other than Lake Erie ports, principally the furnaces at South Chicago.

The following tables show receipts at Lake Erie ports and amounts on dock during five years past:

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

Ports.	1903.	1902.	1901.	1900.	1899.
Toledo	652,305	1,037,571	798,298	645,147	792,348
Sandusky	130,532	165,556	33,017	154,542	87,499
Huron	486,106	520,646	431,311	321,914	263,600
Lo ain	990,490	1,142,417	721,662	1,090,235	1,112,946
Cleveland	4,434,160	4,873,318	3,831,060	3,376,644	3,221,582
Fairport	1,434,342	1,538,744	1,181,776	1,085,554	1,241,013
Ashtabula	4,242,160	4,796,805	3,981,170	3,709,486	3,341,526
Conneaut	3,903,937	4,300,301	3,181,019	2,556,631	2,320,696
Erie	1,257,798	1,717,298	1,379,377	1,240,715	1,309,961
Buffalo					
Tonawanda					
Total	2,149,401	2,256,798	1,475,386	1,616,919	1,530,016
Total	19,681,731	22,649,424	17,014,076	15,707,787	15,222,187

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS.

Ports.	1903.	1902.	1901.	1900.	1899.
Toledo	106,710	310,023	254,193	242,375	183,422
Sandusky	95,275	95,175	47,384	95,111	24,181
Huron	253,249	232,764	231,501	211,377	164,480
Lo ain	288,581	328,304	195,863	251,838	337,822
Cleveland	1,337,750	1,500,604	1,375,060	1,337,445	1,200,806
Fairport	845,946	924,236	710,590	611,717	692,147
Ashtabula	1,911,911	1,967,136	1,769,145	1,811,459	1,962,598
Conneaut	591,364	673,679	604,106	630,514	468,808
Erie	657,409	722,966	470,718	480,734	361,335
Buffalo	282,890	319,367	198,100	232,100	192,681
Total	6,371,085	7,074,254	5,859,963	5,904,670	5,530,283

DATES OF CLOSING AT SAULT STE. MARIE CANAL.

The American locks at Sault Ste. Marie canal closed on Tuesday the 15th inst. Navigation in the canal was in reality at an end on Friday the 11th when the wrecked steamer John T. Hutchinson passed through accompanied by the tugs Favorite and Merrick. Only a dredge or two followed later. Following are opening and closing dates of the American locks since 1855:

Date	Open.	Close.	Date	Open.	Close.
1855.....	June 18	Nov. 23	1880.....	Apr. 28	Nov. 15
1856.....	May 4	Nov. 28	1881.....	May 7	Dec. 5
1857.....	May 9	Nov. 30	1882.....	Apr. 21	Dec. 3
1858.....	Apr. 18	Nov. 20	1883.....	May 2	Dec. 11
1859.....	May 3	Nov. 28	1884.....	Apr. 23	Dec. 10
1860.....	May 11	Nov. 26	1885.....	May 6	Dec. 2
1861.....	May 3	Nov. 14	1886.....	Apr. 25	Dec. 4
1862.....	Apr. 27	Nov. 27	1887.....	May 1	Dec. 2
1863.....	Apr. 28	Nov. 24	1888.....	May 7	Dec. 4
1864.....	May 2	Dec. 4	1889.....	Apr. 15	Dec. 1
1865.....	May 1	Dec. 3	1890.....	Apr. 20	Dec. 3
1866.....	May 5	Dec. 3	1891.....	Apr. 27	Dec. 7
1867.....	May 4	Dec. 3	1892.....	Apr. 18	Dec. 6
1868.....	May 2	Dec. 3	1893.....	May 1	Dec. 5
1869.....	May 4	Nov. 29	1894.....	Apr. 17	Dec. 6
1870.....	Apr. 20	Dec. 1	1895.....	Apr. 25	Dec. 11
1871.....	May 8	Nov. 29	1896.....	Apr. 21	Dec. 8
1872.....	May 11	Nov. 26	1897.....	Apr. 21	Dec. 14
1873.....	May 5	Nov. 18	1898.....	Apr. 11	Dec. 14
1874.....	May 12	Dec. 2	1899.....	Apr. 26	Dec. 20
1875.....	May 12	Dec. 2	1900.....	Apr. 19	Dec. 16
1876.....	May 8	Nov. 26	1901.....	Apr. 20	Dec. 21
1877.....	May 2	Nov. 30	1902.....	Apr. 1	Dec. 20
1878.....	Apr. 8	Dec. 3	1903.....	Apr. 9	Dec. 15
1879.....	May 2	Dec. 3			

IMPROVEMENT OF THE DETROIT RIVER.

One of the Assistant United States Engineers gives an interesting Account of Methods Pursued in Deepening Lake Channels, of Dredging Plant used, Costs, etc.

Mr. Charles Y. Dixon, assistant United States engineer at Detroit, has for a number of years been in charge "on the work," as the term goes, of extensive dredging operations in the lower part of the Detroit river-operations that are costing the government millions of dollars and in which the best practice of the lakes is developed. At a recent meeting of the Detroit Engineering Society Mr. Dixon presented a great deal of valuable information regarding this work. His paper on the subject follows:

The improvement of the channels connecting the waters of the great lakes has been in progress under the United States engineer department for more than a quarter of a century. During this time the commerce has grown to proportions which would not have been predicted at the time of the beginning of the work. In the early stage of this improvement, vessels were limited to about 13 ft. draught and the improvement required consisted only in the removal of isolated obstructions to navigation. With the gradually-deepened channels came larger and deeper draught vessels, resulting in demands for still further improvement. To meet these increasing demands, the United States has expended and is now expending more money for the improvement of the harbors and channels of the great lakes than has any other country for a like purpose.

In preparing this paper it was hoped to interest you by a statement of what has been and is now being done to improve the channel of the Detroit river, and also by a description of the methods of carrying on this work. For a number of years after the beginning of the improvement of the channel of the Detroit river this work was carried on intermittently under a number of small appropriations and it was confined to critical points where the results would be immediately available. Prior to any improvement there was a greater depth of water near the Canadian shore at the mouth of the Detroit river than elsewhere and it was but natural for traffic to seek this deeper channel. Thus it was that nature is mainly responsible for the selection of that channel for improvement which has since come to be known as the Canadian channel. Other routes have since been surveyed for the purpose of preparing estimates in order to make a comparison of costs, but the Canadian channel was found to be the cheaper. It must be remembered that the main purpose for which appropriations for the improvement of channels are made is to cheapen transportation, and it affects this purpose not at all even though traffic does follow the Canadian shore for a few miles. It remains for the engineer to select that route through which the desired results may be obtained for the least cost. Thus has continued the improvement of the channel near the Canadian shore at the mouth of the Detroit river by the United States.

At the beginning of the improvement of this channel (in 1874) vessels were limited in draught to 13 ft., the main obstruction at this depth being then (as now at a greater draught) a ledge of limestone bedrock extending over about $\frac{1}{2}$ mile length of channel near the mouth of the Detroit river. The first work done towards the excavation of a deep channel through this ledge of limestone was performed by the Canadian government in 1875, and but very little was accomplished when their funds were exhausted. They have since preferred to expend their money for channel improvements at other places, leaving this work to be done by the United States.

The first excavation at the Lime-Kiln crossing under the United States war department was made in 1876 by Messrs. Case & Jennings of Dunkirk, N. Y., at the then exceedingly low price of \$7.50 per cubic yard, scow measurement. The first project under which this expenditure was made contemplated a curved channel, 300 ft. wide and 20 ft. deep, following the natural direction of the current, but this project was afterwards so modified that the improvement under later appropriations provided a straight channel 440 ft. wide and 20 ft. deep (or 19 ft. deep at the last average mid-summer or high-water stage). This work was completed in 1890, when it was found that in order to make this increased depth available much additional work was required both north and south of Lime-Kiln crossing. This work has since been carried on with the view to obtaining a channel of 600 ft. width and 21 ft. depth (at the last midsummer or high-water stage) with an additional widening to a maximum width of 800 ft. at critical points in order to straighten the channel. The channel is now improved to this depth for a width of 600 ft. along the Ballard's reef range (north of Lime-Kiln crossing); for a width of 180 ft. along the west side of a 600-ft. channel at Lime-Kiln crossing; for a width of 500 ft. along Amherstburg reach (work on the additional 100 ft. along the east side being retarded by the claims of the adjacent shore property owners); and for a width of 600 ft. throughout the greater part of the length of Hackett range. Through Bar point shoals the channel depth secured was 20 ft. for a width of 800 ft.

The material removed in order to secure this improvement was mainly limestone bedrock, except from Lake Erie to a point about half a mile south of Bois Blanc island, where the material was sand and clay in places mixed with small boulders, these boulders being mainly loose pieces of limestone. At Ballard's reef and Amherstburg reach the limestone was generally underlying from 1 to 3 ft. of loose material, consisting of sand, clay, and small stones. The money expended to date on this improvement by the United States is approximately \$2,750,000; and the unit prices for the removal of rock have ranged from \$7.50 to \$2.27

per cubic yard, and for earth, including loose boulders, from \$0.50 to \$0.18 per cubic yard.

METHODS EMPLOYED IN MAKING SURVEYS.

A brief description of the methods employed in making the necessary surveys prior to the actual work of excavation may be of interest. A system of triangulation is first established with a sufficient number of stations at convenient places to locate all points within the area to be improved, these stations being used for the location of points both during the progress of the survey and during the actual work of excavation. The triangulation stations are, for convenience, referred to rectangular co-ordinate axes with the origin at a centrally located station for the whole system, the axes being north and south and east and west lines. The equations of the channel lines are then computed referred to these axes, and a system of cross-sections (at right angles to the channel lines) adopted. The co-ordinates of the ends of cross-sections at 500 ft. intervals are then computed, and from these co-ordinates and the co-ordinates of two triangulation stations are computed the azimuths of lines to the ends of the cross-sections from the stations, which stations are so selected that the lines give a fairly good intersection angle (not less than 45°). Having made this preparation (which consists largely of office work), the actual work is started of making the survey, which survey consists in the taking of soundings at regular intervals (usually 10 ft. apart) and in sweeping with suspended bars to locate obstructions. The work of taking soundings is usually done through the ice when opportunity offers, or, if there is urgent need during the open water season the soundings are taken by the use of stakes driven or floats anchored at the ends of cross-sections; these stakes or floats being connected by lines with tags equally spaced, and the soundings taken at the tags from boats. If the work is located conveniently near to shore, open water soundings are preferably taken from a raft (say 100 ft. long and 20 ft. wide) anchored in the desired positions. By whatever method the work is done, whether through the ice or in open water, the location of all points is determined by the computed azimuths from properly selected triangulation stations.

On the ice soundings are taken through holes made by boring machines with a lead suspended by a fine wire wound on a wheel 10 ft. in circumference, both boring machine and sounding wheel being mounted on sleighs. This method of making surveys is much cheaper and more satisfactory than when made in open water, but the formation of ice on the Detroit river of sufficient thickness for safety cannot be depended upon every year at the places where needed. The cost of making surveys through the ice varies from $1\frac{1}{2}$ to 3 cents per sounding, and in open water the cost varies from 3 to 7 cents per sounding; in either case this variation is due to weather and other causes.

Whatever the method of making the survey, the time when the sounding is taken and the depth of water are both recorded, and also at a convenient place near the work an observer records the elevation of the water surface at equal intervals of time (say every ten minutes). This is necessary in order that the proper correction may later be applied to each sounding to reduce it to the assumed plane of reference. The necessity for water-gauge readings being taken during the progress of a survey will be appreciated by all when it is known that the daily fluctuation may be as much as a foot, even under moderate weather conditions.

The field work of making the survey being completed, the soundings are reduced to the reference plane, and the reduced soundings plotted. The estimates of the amounts of material above the required depths are then computed, the specifications to control the work of excavation prepared, and the contracts let to the lowest bidder after due advertisement, provided that the necessary funds for the work are available.

MEASUREMENTS IN PAYING FOR THE WORK.

In making payments for excavation, one of three methods is usually adopted, viz., on the basis of bank measurement, on the basis of scow measurement, or on the basis of time work. It has been found more desirable to make the payment on the basis of bank measurement, or material measured in place, where accurate surveys may be made covering the area to be improved. In contracts of this nature, payment to the required depth is made at the full contract rate; and, for rock work, payment is also made at half the contract rate for all material removed for the first 2 (or in some cases 3) ft. below this depth, but in earth this half rate usually applies only to the first 1 ft. below the required depth. By this means payment is made for all material necessarily removed by the contractor in order to secure the depth required. During the progress of the work monthly payments are made on the basis of scow measurements, these payments being corrected from time to time by computations from surveys covering the areas improved.

Payment is usually made on the basis of scow measurement where accurate surveys covering the area to be improved have not been made and the outlines of the work cannot be clearly defined. This method is not satisfactory, as there is always the temptation for the contractors' employees to dig deep pools in soft material, to underload the scows, and in other ways to "beat the government." It is only fair to state, however, that dredging contractors generally do not encourage this, their employees being actuated mainly by a desire to make a good showing for their work, which desire is truly commendable when applied in a legitimate way. Payment is made on the basis of time work, or at a stated price per hour for the actual time worked by the dredging plant, only when the work to be done cannot be definitely

described or is of an experimental nature, or in cases of emergency. For general purposes this kind of a contract has been found to be the least satisfactory and the most expensive. The work performed by a dredging plant under this kind of a contract is usually only about 75 per cent. as efficient as when payment is made under either of the other methods. This must be expected, for the reason that the power will not be applied to the point where breakages and expensive delays are liable to result.

The methods and machinery used by the successful contractor in performing the actual work of excavation would make service on such work a good school for the young engineer. The improvement in these methods and machinery during the past twenty-five years has kept pace with improvements along all other lines where machinery has been made to do man's work. This improvement has resulted in work being performed at less than half of the former cost although the price paid for labor and materials is fully a third higher now than then. In this paper it is intended only to describe the methods and machinery now in use.

At the mouth of the Detroit river it is usually necessary to drill and blast the material before it may be excavated. The drill boats in use are from 60 to 80 ft. long and from 25 to 30 ft. wide, and are held in position by four spuds one at each corner. They are equipped with two or more Ingersoll steam churn drills supported on vertical frames having trucks to permit of the drills being moved horizontally along the edge of the boat. The drills are raised and lowered during the operation of drilling by hydraulic lifts. The boiler furnishes the steam for operating the drills, the pumps used in connection with the hydraulic lifts, the forge, the electric light plant, and other machinery with which the ordinary drill boat is equipped. The drill boat usually serves the purpose of a machine shop where repairs are made to the entire dredging plant. It is always conveniently near to all parts of the work, and ordinary repairs are quickly made, the contractor usually providing a great variety of tools and machinery for use in cases of emergency. It is mainly in details of this kind where the profits or losses to the contractor are made.

OPERATION OF DRILL BOATS AND DREDGES.

The drill boats are usually operated day and night. The holes (about 2½ in. in diameter) are made at the corners of 5-ft. squares to a depth of about 3 ft. below the required depth at the rate of about 5 ft. per hour per drill. The amount of explosive used is about one pound of 60 per cent. dynamite per linear foot of drilling. The holes are charged by inserting the sticks of dynamite with the exploder and battery wires attached into the bottom of a long pipe, the battery wires leading out through a slit in the side of the pipe. This pipe is lowered into the drilled hole, the dynamite shoved down with a long ram rod, and the pipe withdrawn, a wire spring clamped to the dynamite stick preventing its coming out of the hole. The wires are then attached to the battery and the dynamite exploded. During this operation the drill boat is not moved, nor does the work of operating the other drills cease except at the time of firing. On two occasions, however, the charge of dynamite came out of the hole and was exploded directly underneath the boat, causing it to sink almost immediately. This may be attributed to carelessness, however, as before exploding the dynamite the battery wires should be drawn up until taut, indicating that it is in place. A quantity of dynamite is always kept conveniently near the work, but no more than one day's supply is kept at the drill boat and this is stored in a small scow trailing off the down-stream end of the boat at a safe distance.

The dredges used in excavating the material are of the type known as the dipper dredge. They vary in length from 80 to 135 ft. and in width from 30 to 40 ft., and are held in position by three spuds (from 34 to 36 in. square), two at the bow and one at the stern. The machinery for operating dredges varies greatly, the best recently-constructed dredges being equipped with machinery for raising the dredge on the forward spuds (known as pinning up) instead of by swinging the dipper as formerly. The dredge is moved forward in the cut by means of the dipper arm, and the width of the cut is usually from 15 to 20 ft. The capacity of the dredge dipper varies from 2 to 5 cu. yds. for rock work, and from 4 to 7 cu. yds. for earth work. The amount of material removed by one dredge per hour varies from 20 to 100 cu. yds. in rock, and from 75 to 125 cu. yds. in earth. The best type of dredges, however, in soft material and under favorable conditions are capable of removing from 250 to 300 cu. yds. per hour. The time delayed for repairs usually varies from one-fifth to one-third of the time actually worked. A United States inspector is stationed on each dredge to see that the work is being performed in accordance with the specifications, and to keep such record as may be required showing the progress made in the prosecution of the work.

After the entire width of the area to be improved has been worked over by the dredge, cut by cut, the derrick scow follows after to remove such loose pieces of rock as may have been left projecting above the required depth. The derrick scows are usually from 80 to 100 ft. long and from 20 to 25 ft. wide and they are equipped with an ordinary hoisting engine and derrick capable of lifting from 12 to 18 tons, and a complete diving outfit. When lifting the boulders, the derrick scow is pinned up and supported on two spuds, each about 1 ft. square. The material to be removed is found by means of an iron bar, about 30 ft. long, suspended from the side of the scow to the required depth. Any obstruction struck by this bar as the scow is swept over the im-

proved area is removed by the derrick by means of a chain, which is placed in position by a diver.

After the area has been thus improved and cleared of obstructions an examination is made on the part of the United States to determine if the required depth has been secured. This examination consists in sweeping the entire area with bars suspended to the required depth. These bars (about 20 ft. long) are suspended by chains from a raft (100 ft. long and 20 ft. wide) built of squared timbers, the raft being held in position by a rope leading to a head anchor and pulled back and forth by means of ropes leading to side anchors. Any obstruction found during this examination is removed by the derrick scow with diving outfit. During the progress of the work, as well as during this final examination, constant attention is paid to the water gauge in order to allow for the fluctuations in the water surface. Following this examination and on the completion of the work required under the contract, the final survey is made, which survey consists in the taking of soundings at regular intervals as described above. On this final survey and on the original survey depend the estimate for final payment.

The cost per month of operating a dredging plant such as is used on the Detroit river is about as follows:

Drill boat operated 24 hours per day by double crews	\$3,000
Dredge operated 12 hours per day	2,500
Derrick scow operated 10 hours per day	1,500
Tug operated 12 hours per day	750
Total	\$7,750

FLUCTUATION OF WATER SURFACE AT THE LIME-KILNS.

In this paper, reference has been made to the fluctuation of the water surface at the mouth of the Detroit river, and as this fluctuation at times seriously affects the interests of navigation it is worthy of further consideration. Prior to 1896, tri-daily water gauge readings were taken from a staff gauge nailed to the dock only during the season of active operations (from May to November); from 1896 to 1899 these readings were continued during the entire year; in May, 1899, a self-registering water gauge was installed and since that time the record has been complete. The change in the elevation of the water surface is at a maximum during the late fall months, and this change is due to the direction and force of wind and inequalities of barometric pressure. The maximum daily fluctuation since May 1899 was 5.8 ft., caused by the gale of Sept. 12, 1900, the length of time elapsing between the highest and lowest stages being 9 hours. The extreme fluctuation since May 1899, was 7.55 ft., the highest stage being 574.45 ft. above mean tide at New York on Sept. 24, 1902, and on Sept. 7, 1903, and the lowest stage being 567.30 on Nov. 21, 1900. Daily fluctuations of from 1 to 2 ft. are not infrequent, causing vessels to be detained on account of low water at Lime-Kiln crossing. To give some idea of the extent of this detention the following information has been compiled:

	Depth at crossing less than	Hours duration.
September and October	17.5 ft.	212
November	17.0 ft.	141
September and October	18.0 ft.	86
November	17.5 ft.	59
September and October	18.0 ft.	112
November	17.5 ft.	104

The longest continued period of low water was 58 hours on Nov. 17-19, 1903.

At no other place along the channels connecting the great lakes is the change in the water surface so great nor its effect on navigation so serious. In order to make a through channel of 21 ft. depth available at the mouth of the Detroit river during the entire navigation season (except during the period of storms), it will be necessary to deepen this channel about 2 ft. below the grade heretofore adopted. This deepening will soon be undertaken.

With the increase in the number and size of vessels, the blocking of a channel of 600 ft. width may at any time be expected as the result of collision or other accident. It is now therefore apparent that to insure a safe channel to the commerce which may be expected within the next ten years, the present channel will have to be widened or a second channel excavated. Without entering at too great length into this question, it now appears that a second channel would be desirable and also that this second channel should be to the west of Grosse Isle making an all-American route.

Mr. A. Hackett, keeper of the Bois Blanc island light and who also has the care of other aids to navigation near the mouth of the Detroit river, rightfully says that the sinking of the steamer Gladstone in collision at Bar point recently should not in any way be attributed to the condition of channel marks in that vicinity at the time. The buoys, which are maintained by the Canadian government, were then in position and when they were removed at a later date they were replaced by winter buoys. "The steamer Petrel," says Mr. Hackett, "only brought in the gas buoy from Bar point when it was in danger of being carried away by ice and not until some days after the Gladstone had been raised and taken to Detroit. I would also say that all the float lights of the Lime-Kiln crossing and the Amherstburg channel were kept in position until carried away and lost by ice."

SURPLUS ORE AT THE MINES.

Duluth, Minn., Dec. 16.—At mines everywhere in the Lake Superior region stock piles are large, some so big that all room is exhausted. At these no hoisting is under way. Others have more ore than usual and these are running light. There is far more ore on hand in the region, comparative to output, than has been the case in any fall for eight years; probably more actually than ever known.

Steel Corporation railroads in Minnesota will bring this winter to the mills here about 250,000,000 ft. of pine logs. They will also handle to mines and to mills on their lines in the interior from fifty to seventy-five million more, making a large winter's traffic. Their passenger business will be less than a year ago, for the reason that lumberjacks are holding their jobs better than formerly and are not spending their wages for transportation. At the mines quiet prevails. In the Hibbing district only two mines are hoisting ore now (Sellers and Glen) but a number are developing for the coming year. Not a mine is hoisting near Buhl, but the Frantz, a new property of M. A. Hanna & Co., is being developed for shipments in 1904. At Mountain Iron no mine is shipping; none ever has in the winter and one is being developed for next year. At Eveleth both the Fayal and Spruce are working full time underground, with about 600 men, and are hoisting more than 5,000 tons daily. They are also stripping with three shovels at the Fayal. The Troy is being developed also for Pickands, Mather & Co. At Virginia all active operations have ceased except at the Hibbins, a new mine of the Steel Corporation, which is being developed for another year. At Biwabik nothing is under way but there is some stripping at the Holland and at Biwabik, the former by 100 men the latter by two steam shovels. At the new village of Aurora, which started last fall with quite a boom, not a man is working in mines and none will be before spring. These comprise the main mining centers of the Mesabi range.

On the Vermillion day crews alone are working in all mines at Ely except the Chandler, which is on full time. At the other mining location not a ton is being hoisted.

On the Gogebic day shifts are worked in the big mines of Ironwood and Bessemer. At Wakefield the Sunday Lake is closed and the Brotherton is running after a reduction of pay. This reduction will spread later to other mines and other districts.

At Ishpeming and Negaunee on the Marquette range there have been reductions to single shifts everywhere except at the Negaunee, which is running full. At Champion the mine of that name is closed tight. At Republic no change has been made in the force. At Swanzezy the Princeton has cut off half its men. The Bessie, Winthrop, Lucy, Moro, Volunteer and some smaller properties in the Cascade section have closed on this range.

On the Menominee range there is a great curtailment. At the Chapin and Aragon 400 men out of a total force of 1,900 are out. The Iron River section is quiet. At Crystal Falls but three mines are doing anything. At Florence activity prevails. At Norway there is little change. All over this range, as on others, explorations are cut down severely.

EARNINGS OF LAKE CRAFT DURING 1903.

Concerning the newspaper reports that vessel property on the great lakes paid from 5 to 18 per cent. during the season just ended, vessel men are quite willing to admit that they have had a fairly-profitable season, but if any of the big freighters, even the best of them, earned more than 10 or 12 per cent., this including the retirement of the usual portion of bonds that are made a fixed indebtedness for about ten years on nearly all the modern steel boats, their number is very small and they must have been especially fortunate on the score of delays in port. Of course the earnings of the smaller class of wooden vessels were very light, especially in view of the rapid deterioration in the value of this kind of craft. One of the most prominent of the vessel men, whose fleet is exclusively steel and representative of the best, admits that his vessels earned something more than 10 per cent. during the year, out of which, however, the bonds had to be cared for. He was frank enough to say that he regarded the season as fairly satisfactory, adding that he had nothing to complain of and that he had gone through worse. But alike to all of his associates he has great fear of the immediate future, which is by no means encouraging. The large steamers can, as a rule, when confined to the ore trade, make nineteen to twenty round trips in a season, but a large number of them this year went into the coal trade, so that the average number of trips for the season was very much reduced. Coal, indeed, was the anchor to windward during the season. Ore shipments took a perceptible slump in September and a precipitate one during the balance of the year, so that, had the movement of coal been ordinary, many vessels would have gone to dock quite early in the season. But the coal movement continued enormous throughout the entire year. The grain trade was a disappointment. There was talk of a huge corn crop early in the season. There, indeed, may have been, but the harvest did not come to the lakes. Promise and not performance marked the career of grain in the lakes this year. A certain stimulus was given to the trade in general by the temporary withdrawal of a considerable portion of the Steel Corporation's fleet, owing to labor troubles, but this was later, in a measure, destroyed by the activity which the fleet displayed in competing for cargoes in the grain and coal trades.

A while back it looked as though a fight would be waged between the Marine Engineers' Beneficial association and the Masters & Pilots' association over the question of authority on

board ship, with the vessel owner, who has most at stake, an interested but helpless spectator. The master desires to regain his old-time authority on board, with power to employ his crew, and the engineer desires the retention of his present privilege of being employed by the owner direct. But the time seems not now opportune for a clash between divisions of labor and it is likely that both sides to the issue will nurse their grievances until some more favorable time. Owners are probably more in a mood to stand together now than they ever were and are a unit in the belief that there are advantages in a short season.

FLEET AVAILABLE FOR CHICAGO GRAIN.

Chicago, Dec. 16.—As yet there is in sight no inquiry for vessel storage and nothing likely to develop in that line until early in January. At a rough estimate our winter fleet, including Chicago, South Chicago, Milwaukee and Manitowoc, is of about 13,000,000 bu. capacity, as against 8,175,000 bu. capacity a year ago. At Chicago, not including line vessels, we have this year about 1,550,000 bu. capacity; last year 2,300,000 bu. At South Chicago, exclusive of steel boats and liners, this year 850,000 bu. capacity; last year 1,675,000 bu. At Manitowoc this year, 1,250,000 bu.; last year 1,700,000 bu. At Milwaukee there is a considerable fleet of vessels, something around 9,500,000 bu. capacity as compared to 2,500,000 bu. a year ago. All the elevators have considerable idle storage space but it is expected that the cold and dry weather of the past several days will help to condition the corn and stimulate some extra movement from the country points. The movement by lake having closed for the season this week's shipments, noted below, and which are furnished by P. H. Fleming & Co., vessel agents, are for account of all-rail, with the exception of 58,000 bu. of wheat and 101,000 bu. of oats, which lots went by lake to Canada (Parry Sound).

CHICAGO GRAIN SHIPMENTS, LAKE AND RAIL.

	This week.	Last week.	Same week last year.
Wheat, bu.	237,916	1,646,524	83,415
Corn, bu.	520,095	1,432,625	600,913
Oats, bu.	809,232	1,117,910	1,223,800
Rye, bu.	40,324	21,049	19,670
Total, bu.	1,607,567	4,218,108	1,927,798

	Since Jan. 1, 1903.	Same time last year.
Wheat, bu.	23,871,097	30,036,541
Corn, bu.	88,929,402	43,892,866
Oats, bu.	61,865,719	55,344,901
Rye, bu.	2,800,598	2,789,775
Total, bu.	177,466,816	132,064,083

Stocks of grain in public and private elevators are thus reported:

	Week just closed.	Last week.	Same week last year.
Wheat, bu.	5,571,000	5,336,000	11,201,000
Corn, bu.	4,954,000	3,230,000	1,816,000
Oats, bu.	3,353,000	3,123,000	2,831,000
Rye, bu.	368,000	133,000	437,000
Total, bu.	13,346,000	11,822,000	16,285,000

NEW HEADQUARTERS FOR LAKE SHIPPING.

For ten years or more the Perry-Payne building in Cleveland has been the center of iron ore, coal and vessel interests of the great lakes. It is quite apparent now, however, that the new Rockefeller office building, which is to be erected on the site of the old Weddell house, will not lack tenants of a shipping kind. Notwithstanding the fact that the foundation of the structure is not yet laid considerable space in the building has already been let, some of it to big vessel concerns that will undoubtedly be followed by their neighbors of the Perry-Payne building. The choicest location of all has been secured by the Central National Bank. It will occupy the corner location, fronting on Superior street and running back a considerable distance on Bank. The only other space on Superior street will be occupied by the Union National Bank. A third bank, probably a trust company, is to occupy the ground floor on Bank street, and these three will consume all the ground floor space. The upper floors will be so partitioned that a tenant may occupy the whole floor, or two-thirds of it, or half of it, or any subdivision of it compact that he may want. The United States Steel Corporation and M. A. Hanna & Co. are understood to have each leased one floor, and it is said that J. C. Gilchrist has also arranged for spacious quarters in the new structure. As vessel interests are a gregarious lot, as indeed are all divisions of business and professional life these days, it is quite natural to suppose that the concerns named will be merely the leaders of the exodus from the Perry-Payne building, which has been the office building for more than half the shipping of the great lakes. The shipping interests have been hampered for space in the Perry-Payne building during the past few years, and the alacrity with which space in the new Rockefeller building has been seized upon merely shows that it is filling a want.

Coal receipts at Chicago by lake are reported as 1,250,615 tons in 1903, compared with 299,512 tons in 1902.

NAVIGATION ON LAKES ERIE AND ONTARIO.

A Highly Interesting Chapter in Mr. Morrison's "History of American Steam Navigation"—First Screw and Compound Engines on the Lakes—Early Experiences in Running the Canadian Rapids.

Especially interesting to men along the great lakes is a book entitled "History of American Steam Navigation," which Mr. John H. Morrison of New York has produced after twenty years of effort. He has gone very thoroughly into the history of navigation on Lake Erie and Lake Ontario and this chapter is excerpted below. It will be noted that he says the first fore-and-aft compound engine on the lakes was placed by the Globe Iron Works of Cleveland in the propeller Egyptian, built at Black river (now Lorain) in 1873. This statement was shown to Mr. Robert Wallace of the American Ship Building Co. who verified it, adding that the first steple compound on the great lakes was placed in the steamer Susquehanna in 1867 under the Perry & Lay patent. This work was done by the King Iron Works at Buffalo. The Susquehanna was built by Luther Moses at Cleveland and was originally equipped with a high-pressure engine with a cylinder of 24 by 36 in. Later steple-compounds were placed in the Buffalo and Chicago of the Western Transit Co.'s fleet, Quayle of Cleveland supplying the engines.

It is quite clear that Mr. Morrison has been at much pains to obtain accurate information for his work and has, wherever possible, examined original documents. Indeed it is only through the examination of private papers that history can be accurately traced and he has exhibited commendable zeal in the pursuit of a subject which is evidently very fascinating to him. He has not attempted to trace the history of every steamer ever built in the United States, for that would be as obviously impossible as it would be uninteresting, but he has endeavored to go fully into types. The vessels named or historically noted are those that were in their day a radical change, either in hull or machinery, or that were prominently connected with some of the lines that have come into notice during the development of American steam navigation interests. The chapter on the history of navigation on Lakes Erie and Ontario is as follows:

Steam navigation on the lakes dates from the year 1818, when the steamboat Walk-in-the-Water was built to ply on Lake Erie. The hull of this vessel was built at Black Rock, N. Y., by Noah Brown of New York city for James B. Stuart of Albany, Robert McQueen of New York city, and others. The vessel was 135 ft. long, 32 ft. beam and 8 ft. 3 in. depth of hold, and was brig-rigged. The engine was a low-pressure of the square-engine type, having a cylinder of 40 in. diameter and 4 ft. stroke, built by Robert McQueen. This engine was transported by sloops to Albany from New York, and from there to Buffalo by six and eight-horse wagons, taking from fifteen to twenty-five days for the delivery. The materials for the boiler were sent to Black Rock, and the boiler built near where the hull was constructed. It was of copper, 24 ft. long and 9 ft. diameter, with one "kidney" flue. The engineer of the vessel was James Calhoun of New York city.

The first trip of the vessel was from Buffalo to Detroit, leaving the former port on Aug. 20, 1818, under Capt. Job Fish. The time consumed in the trip was usually thirty-six to forty hours in good weather, and using thirty-six to forty cords of wood in the boiler during the same period. The passenger fare in the main cabin was \$18 between Buffalo and Detroit; between Buffalo and Sandusky, \$15; between Buffalo and Cleveland, \$12; and between Buffalo and Erie, \$6.00. The strength of the rapids at the head of the Niagara river between Buffalo and Black Rock was so great that, besides the power of the engine, the steamer had to have the aid of eight yoke of oxen to get her up on the lake, a distance of about 2½ miles. In those days the passenger and freight traffic was so limited on the lakes that one dividend only was made to the owners for three years from the earnings of the vessel. Mr. Calhoun, the engineer of the vessel, said in latter years of his experience in those early days: "Every two years I used to return to New York from Buffalo in the fall, and in the spring return to Buffalo. I have been three or four days by stage to Albany, never less than three days, and sometimes near five days. The stage fare was \$10 to Albany. From Albany to Buffalo I have been ten days getting through—the shortest time was eight days. The stage fare through was \$21. My usual expenses in going from Albany to Buffalo were \$30, including hotel expenses." After doing service a little over three years this vessel was wrecked in Buffalo bay during a heavy gale on Nov. 1, 1821. No lives lost.

In 1822 Noah Brown also built the Superior for the same owners at Buffalo, as a successor to the Walk-in-the-Water. This vessel was of different proportions in the hull from her predecessor. While but 9 ft. shorter, she was over 11 ft. less beam, with over 2 ft. greater depth of hold. The dimensions were 126 ft. by 20 ft. 8 in. by 10 ft. 6 in. The machinery was recovered from the wrecked vessel and placed in the Superior. This engine was subsequently fitted in the steamboat Charles Townsend, built in 1835, at Buffalo, by Carrick & L'cwell, after the Superior had been altered into a sailing vessel by the removal of her machinery, and used in the lumber trade on the upper end of Lake Erie, and was lost in 1843.

In 1824 the Chippewa of 100 tons, and in 1825 the Henry Clay of 348 tons were built, but both were broken up after short service. In the latter year the Pioneer was built by Benj. Winslow for A. S. & P. T. Porter, Sheldon Thompson and nineteen others, at Black Rock. Her length was 93 ft.; beam, 16 ft. 9 in.; and 8 feet depth. This vessel was twice wrecked—once at Grand

river, O., in November, 1825, and was finally beached in a gale of wind near Chicago in July, 1834.

In 1829 there was built at Portland harbor, Chautauqua county, New York, the William Peacock, by Asa Standart, for Eliphalet Tinker, Joseph White and thirty others. Length, 102 ft., 19 ft. beam and 7 ft. 6 in. depth of hold. The vessel was originally fitted with a low-pressure engine, built at Troy, N. Y., but after running one season this was removed and one on the high-pressure principle, built by Stackhouse & Tomlinson at Pittsburg, Pa., was erected in its place, with four boilers under the deck. On September 16 of the same year, as the vessel was leaving Buffalo harbor for Detroit with a heavy head sea running, her steam pipe broke, there being no slip joint in the pipe, resulting in the loss of fourteen lives—all passengers. She finally went ashore near Erie, Pa., in 1832 and became a total loss.

In 1834 there was built at Perrysburg, O., by Augustus Jones, for the Perrysburg Steamboat Co., the Commodore Perry. This vessel was 146 ft. 2 in. long, 26 ft. 4 in. beam, and 9 ft. 9 in. depth of hold; was fitted with one horizontal high-pressure engine, built by P. B. Andrews of Cleveland, with boilers below deck. These boilers were the subject of two accidents during the first season by the collapsing of the flues, due to defective iron of which they were made, and resulting in the loss of four lives.

There was running from Buffalo, a few years later, the Buffalo of 613 tons; the De Witt Clinton of 413 tons; the Wisconsin of 490 tons, built at Conneaut, O., and having an engine that was taken from the Ohio on the Hudson river; Robert Fulton of 368 tons; Milwaukee of 401 tons, built at Grand island in 1837, and fitted with a beam engine from the West Point Foundry, New York city (this vessel was 172 ft. by 24 ft. by 10 ft., and was wrecked on Lake Michigan in 1842); Charles Townsend of 312 tons; Daniel Webster of 358 tons; Constellation of 438 tons; Fairport of 259 tons; Red Jacket of 158 tons, a small boat of 110 ft. by 16 ft. by 8 ft., built at Grand island in 1838 for Niagara river service, with a beam engine taken from steamboat Victory on the Hudson river. Eight of these vessels had low-pressure engines, all being built at New York, either by the Allaire Works, West Point Foundry, or Birbeck & Co., and four had high-pressure engines, built by Ward & Benne of Pittsburg, Pa.

The Caroline, which was brought into such prominence in 1837 by being burned by a body of Canadian militia during an attempted invasion of the province, was a small vessel of 46 tons and was built at Charleston, S. C., in 1824. She was on the Hudson river between Albany and Troy about 1834, after which she was taken through the Erie canal to Buffalo, which was accomplished by taking off her wheel guards. A short time after she was rebuilt at Ogdensburg, N. Y., and subsequently went to the Niagara river, where she was burned as previously mentioned.

Among the largest steam vessels on the lakes prior to 1840 was the James Madison, which was 178 ft. long, 30 ft. 9 in. beam and 12 ft. 6 in. deep; draught of water 10 ft. She was fitted with a high-pressure engine of 28 in. cylinder and 8 ft. stroke, built at Erie, Pa. The passenger accommodations were the best of her day, and the service covered the route between Buffalo and Chicago, a distance of nearly 1,000 miles. Another fine vessel was the Cleveland, built in 1837 at Huron city for Griffith, Beebe, Allen & Co., with a beam engine, built by the West Point Foundry, of 50 in. cylinder by 10 ft. stroke. The hull dimensions were 186 ft. by 29 ft. by 11 ft. 8 in. She was destroyed by fire at Tonawanda, N. Y., in 1854.

FIRST STEAMER TO HAVE STATEROOMS.

The most radical departure in steamboat design and construction in the early days was that made in the building of the Great Western. This vessel was built at Huron, O., in 1838, and was 186 ft. by 34 ft. by 13 ft., with a high-pressure engine, 29 in. cylinder by 10 ft. stroke, and seven boilers. During the two years in which this vessel was building, and also after her appearance upon Lake Erie in service, those who were supposed to be judges in lake navigation expressed grave doubts of the seaworthiness of that type of vessel. But in a few trips she became a favorite with the traveling public, notwithstanding the opinions and prejudices of a few. This was the means of making great changes in the construction of steam vessels on the lakes, converting the lower cabins into steerage quarters and freight compartments, and adding the upper cabin with staterooms. The vessel was designed and modeled by Capt. A. Walker, her owner. She was partially destroyed by fire in 1839, but was rebuilt and continued in service until 1855, when broken up. The Anthony Wayne and the James Madison had, previous to this, on the upper deck between the wheel houses, each a few rooms used for smoking rooms and card playing, but the houses on the Great Western were the first with staterooms for passengers on the lakes. Staterooms had many years before this been in use on some of the Mississippi river steamboats.

The want of safe harbors, and the means of easy communication with the interior of the neighboring states, was the reason of the slow progress of lake navigation until the year 1832, when, by the completion of the Welland canal and the Ohio canals, and the improvement of the harbors on the shore of Lake Erie, further communication was opened with the outer world, both to the south through the state of Ohio and to the east from Lake Ontario. The Erie canal had been opened through New York state since 1825. In 1836 there were on the lakes forty-five passenger steam vessels. In 1839 the number had increased to sixty-one steam vessels. The largest at this time was the Illinois, built in 1838, whose dimensions were 205 ft. by 29 ft. by 13 ft., with an engine of 56 in. by 10 ft. stroke, and running from Buffalo to Chicago. The largest then running to Detroit was the Erie.

built at Erie, Pa.—hull 176 ft. by 27 ft. by 10 ft., and having a beam engine of 52 in. by 10 ft. stroke, and average speed of about 12 miles per hour. The cabin fare at this time between Buffalo and Detroit was \$8, including meals. The Illinois usually made the trip to Chicago in five days and return to Buffalo in four days. Cabin passage from Buffalo to Chicago, \$20; Detroit to Chicago, \$10. There were several small steam vessels devoted mainly to freighting, such as the United States, 140 ft. by 28 ft. by 10 ft., with a high-pressure engine 23 in. by 7 ft., built at Pittsburg, Pa.

As the number of vessels constructed during a few years prior to 1840 was quite large—larger than was warranted by the increase of passenger and freight business—sharp competition had set in and passenger rates were cut as low as \$4 to Detroit from Buffalo, extras included. This condition did not, however, continue very long. In June, 1839, an association was formed, comprising many of the principal owners of the lines on the lakes, the object of which was to regulate the number of vessels retained in commission, according to the needs of the business between Buffalo, Detroit and Chicago, and to retire from service all those found to be unnecessary; also to fix a regular tariff for passenger travel and freight rates that should prove more beneficial to the steamboat interests than those previously in force. There were about thirty steam vessels represented in this association. The combination did not remain in force for any great length of time.

FIRST PROPELLER ON THE GREAT LAKES.

The introduction of the propeller on the northern lakes was first inaugurated by the arrival on Lake Erie, early in 1842, of the *Vandalia*, a sloop-rigged craft, built at Oswego and of 150 tons. In 1842 the *Chicago* and the *Oswego*, each of 150 tons, were built at Oswego. The *Hercules* and the *Sampson*, the former built at Buffalo and the latter at Perrysburg (1843), were the first built on Lake Erie. These propellers were thus referred to at that date: "The building of the propeller *Hercules* is the commencement of a new era in steam navigation on the lakes, and her owners predict for that description of vessel a large share of the carrying trade, especially upon the upper lakes. The *Hercules* is 137 ft. long, 25 ft. beam, 8 ft. hold, and she is put together in the strongest manner. She has fourteen staterooms, 6 ft. square, with sufficient additional space for the erection of forty-six more berths, and from the peculiar symmetry of the *Hercules* she will doubtless afford ample accommodations for families emigrating. Her space below for storage is large, having almost the entire hull of the vessel appropriated for that purpose. The peculiar feature, however, of the *Hercules* is her engine and its auxiliaries. On examining the machinery, all are struck with the infinite compactness of the steam apparatus, and its perfect simplicity, the whole weighing but 15 tons. The engine is simple and very small, lies close upon the keelson and fills but a space of 6 ft. square. It is one of Ericsson's patent, was made at Auburn, and is computed to be of 50 H. P. The weight of an engine and boilers for one of our largest steamers is estimated at from 60 to 70 tons, the dead weight of which a propeller escapes carrying. The paddles are made of boiler iron, $\frac{3}{4}$ in. thick, 18 in. broad by 30 in., and are placed on two long wrought-iron shafts protruding from either side of the stern post. The diameter of the paddles (screws?) are 6 ft. 4 in. From the superb manner in which the *Hercules* is built and fitted out, having cost nearly \$20,000, it is apparent that the enterprising proprietors are determined to give the experiment a full and fair trial. Another boat of the same tonnage, for the same owners, is now being built at Perrysburg, and will be out next month. Ten cords of wood, at a cost of \$17, will suffice the propeller per diem, while one of our largest steamers will consume two cords per hour, at a cost of \$80 per day. Some of the steamers even exceed this calculation by 33 per cent."

These two propellers had each two high-pressure engines, with 14 in. cylinders and 28 in. stroke. The propeller had taken a strong hold on the lakes at this early period, and many vessels were fitted with the screw propeller, and most all were driven by the high-pressure or non-condensing engine. Some of the larger ones about 1850 may be said to have been: *California*, with two high-pressure engines, 18 in. by 34 in., and 8 ft. wheel; *Delaware*, one high-pressure engine, 20 in. by 42 in., and 7 ft. 6 in. wheel; *Globe* and *Goliath*, each two high-pressure engines, 16 in. by 28 in.; *Manhattan*, 140 ft. by 24 ft. by 10 ft., with two high-pressure engines, 16 in. by 32 in., with an 8 ft. wheel; *Oregon*, 140 ft. by 23 ft. by 9 ft. 10 in., with two high-pressure engines, 16 in. by 28 in., and a 7 ft. wheel.

After 1855 screw propellers of increased size were built, and, proving themselves well adapted to the trade of the lakes, especially through the canal, they quickly began to take the place of the side-wheel boats. The year 1861 may be said to have been the beginning of an era for propellers on the lakes of 1,000 tons and over. Since then side-wheel boats are only used on some special passenger service.

ERA OF LARGER VESSELS DATES FROM 1844.

The era of larger vessels began in 1844, with the construction of the *Empire* of 1,140 tons, 253 ft. by 32 ft. 8 in. by 14 ft., with high-pressure engine of 45 in. by 10 ft., and two boilers, and water wheels 30 ft. by 11 ft. There was also the *America*, running from Buffalo to Chicago, hull dimensions being 225 ft. by 34 ft. by 12 ft.; draught, 8 ft., with two high-pressure engines, built by Yeatman & Shields of Cincinnati, O., each engine having cylinder 30 in. diameter by 11 ft. stroke, and seven boilers, working under an average pressure of steam of 90 lbs., cutting off at 4 ft. 2 in.; water wheels, 34 ft. by 10 ft. 6 in. Then came the *Ni-*

agara, built at Buffalo in 1845, of 1,100 tons, 230 ft. by 33 ft. 6 in. by 14 ft., with a beam engine, 65 in. by 10 ft., and three boilers, and water wheels, 30 ft. by 10 ft. These vessels were constructed for passenger travel on Lake Erie and Lake Michigan. A few years later others of increased dimensions were built, the largest being the *Empire State*, built at St. Clair in 1848, of 1,570 tons, 310 ft. by 37 ft. by 14 ft., with a beam engine of 76 in. by 12 ft., constructed by Merrick & Towne, Southwark Foundry of Philadelphia, with water wheels of 38 ft. by 10 ft. At this time the railroads were being rapidly extended from the coast cities to the western states, and in 1851 the New York and Erie railroad controlled a line of steamers comprising the *Niagara*, the *Keystone State* and the *Queen City*, running from Dunkirk to Detroit, connecting there with the railroads to the west. At this time the rivalry between the New York & Erie Railroad Co. and what was subsequently the New York Central Railroad was about as intense as desired, especially for the western travel, that had largely increased in a few years.

Passenger travel by the way of Albany and Buffalo to the west was served on the lakes by a fine line of steamers, one of them being the *Mayflower*, built in 1849 at Detroit, of 1,242 tons, 288 ft. by 35 ft. by 12 ft., with a beam engine, built by the West Point Foundry at Cold Spring, N. Y., of 72 in. by 11 ft., having three boilers below decks and two chimneys; water wheels, 35 ft. by 11 ft. This vessel was finally wrecked on Point Au Pelee in November, 1854, in a fog. In 1854 the Michigan Central Railroad Co. and Isaac Newton and others of New York city, who were interested in the People's Line on the Hudson river, had built at Buffalo two large side-wheel steamers, the *Western World* and the *Plymouth Rock*, to run in connection with the railroad from Albany to Buffalo—which was now the New York Central Railroad—to make a through line from New York to the west of those having a mutual interest. The *Western World* was 337 ft. by 42 ft. by 14 ft. 6 in., and had a lever beam engine, built by the Allaire Works, of 81 in. by 12 ft. stroke. The *Plymouth Rock* was 335 ft. 10 in. by 42 ft. by 14 ft. 6 in., and had an engine of the same type and size as the *Western World*, and by same builder. These were the first vessels built by John Englis of New York after he succeeded to the business of William Brown of that city.

Another line that was running first to Monroe, Mich., and then to Toledo, O., in connection with the railroad from Buffalo, was formed of the *Empire State*, the *Northern Indiana* and the *Southern Michigan*, built in 1852 at Buffalo, N. Y., each being 300 ft. by 36 ft. 10 in. by 13 ft. 7 in., with beam engines, constructed by the Morgan Iron Works, of 72 in. by 12 ft. stroke. The *Northern Indiana* was destroyed by fire on the morning of July 17, 1856, while on a trip from Buffalo to Toledo; fifty-six lives were lost. The *Empire State* having been laid aside, the *Western Metropolis*, 321 ft. by 39 ft. 10 in. by 14 ft. 2 in., was built in 1856 and fitted with the engine from the *Empire State*. Then, in 1857, the *City of Buffalo* was constructed for the same line, being 331 ft. by 40 ft. by 15 ft. 8 in., also having a beam engine, but it was 76 in. by 12 ft. stroke.

From Buffalo to Cleveland there was also in 1853 a line of large side-wheel steamboats, comprising the *Crescent City* and the *Queen of the West*, both built at Buffalo in 1853. The former was 320 ft. by 39 ft. 6 in. by 14 ft., with a beam engine of 80 in. cylinder by 12 ft. stroke, built by the Morgan Iron Works. The *Queen of the West* was 324 ft. by 45 ft. 2 in. by 14 ft. 7 in., with same type of engine as her consort, by Henry R. Dunham & Co. Again, in 1853, there was another line of these large side-wheel steamboats from Buffalo to Sandusky, the *Mississippi* and the *St. Lawrence*, built also at Buffalo the same year. The former was 320 ft. 8 in. by 40 ft. 10 in. by 14 ft., with a beam engine, built by I. P. Morris & Co., Port Richmond Iron Works, Philadelphia, Pa., having cylinder of 81 in. by 12 ft. stroke. The *St. Lawrence* was 326 ft. by 40 ft. by 14 ft., with same type of engine, but built by the Allaire Works. The boilers for the *Southern Michigan*, the *Northern Indiana*, the *Crescent City*, the *Queen of the West* and the *St. Lawrence* were constructed by the Shepherd Iron Works at Buffalo. These works were established in 1847.

These were all fine-modeled vessels, were handsomely furnished for the passenger travel on the lakes, and most of them had ample power in their engines to give them high speed. They were in external appearance like to the larger of the Long Island sound boats of that day, with an increased depth of hold, as they more often met heavy weather than the eastern boats. Another feature in that they differed from the eastern type, but was shortly after adopted by the latter, was the extension of the joinder work on the forward main deck to the stem of the vessel. These vessels found their employment gone when the railroads bordering on Lake Erie had made their connections in 1857. They continued in some cases for a year or so longer, but in the course of two years so much of the passenger travel had been absorbed by the railroads that it was no longer profitable to run them on their routes, and they gradually passed to other employment after their machinery had been removed. The hull of the *Western World* was used for a floating dry dock at Cleveland, that of the *Mississippi* was used for a similar purpose at the same city; also one at Buffalo and another at Erie. The *St. Lawrence* was altered to a barge, the *City of Buffalo* to a propeller, and the *Western Metropolis* converted to a bark. To such base uses had a fine fleet of steamboats come while yet in serviceable condition. The engines of these vessels subsequently were sent to the Atlantic coast, James Raynot, the promoter of the Star Line to New Orleans, securing three of them, that of the *Mississippi* for the *Guiding Star*, that from the *Crescent City* for the *Morning Star*, and

that from the Queen of the West for the Evening Star. The engine from the St. Lawrence was placed in the Foh-Kien at New York; the Southern Michigan in the Thomas Cornell on the Hudson river; that from the Western World to the Fire Queen; that from the City of Buffalo to the Merio Castle; that from the Plymouth Rock to steamer Plymouth Rock for China waters; and that from the Western Metropolis to the steamship Western Metropolis, operated on the Atlantic coast and built at Brooklyn in 1863.

In 1850 there were on all the Northern lakes 107 side-wheel steamboats, 135 propellers and 1,006 sailing vessels, none of the latter smaller than schooner rigged. This was a large increase in five years.

The first compound engine on the lakes was in the Oregon, built in 1840 and which was 203 ft. long and 28½ ft. beam. These compound engines were built at Pittsburgh and were of the clipper type, western-river style, having cylinders 24 in. and 48 in. by 9 ft. stroke each, with six boilers, and water wheels 28 ft. by 10 ft. This vessel was destroyed by fire at Chicago in 1849. The next was the Buckeye State, built in 1850, and run from Buffalo to Cleveland. This hull was 282 ft. by 32 ft. by 13 ft.; engine, annular cylinder, compound beam; small cylinder, 37 in. diameter; large cylinder, 80 in. diameter; stroke, 11 ft. Steam was furnished by three flue return-tubular boilers. The initial steam pressure in the high-pressure cylinder was 50 lbs. This machinery was built at the Allaire Works, New York city, from designs of John Baird and Erastus W. Smith, engineers. Water wheels were 35 ft. by 9 ft. 3 in.

FIRST COMPOUND ENGINES INTRODUCED ON THE LAKE.

It was on Lake Erie that the compound propeller engine for the merchant service in this country first took form. This does not include the yacht Octavia. The first engines were those altered from simple condensing engines by the addition of a small cylinder, in 1807, under the Perry & Lay patent. The first new engine of that type built was placed in the Jay Gould in 1809. These were steepie compounds. The first fore-and-aft compound engine on the lakes was installed by the Globe Iron Works of Cleveland, O., in the propeller Egyptian, built at Black River, O., in 1873. The King Iron Works of Buffalo in 1875 built one of the same type for the yacht Orizaba, still in commission. The pioneers of the triple-expansion type of engine on the lakes were those in the Cambria, built by the Globe Iron Works Co., Cleveland, and the Romania, built by S. F. Hedge & Co. at Detroit, Mich., both completed in 1887. For the quadruple-expansion type, two came out in 1894, the Northwest, by the Globe Iron Works of Cleveland, and the Unique, by the Frontier Iron Works of Detroit.

Capt. Harry Whitaker of Buffalo obtained a patent, Oct. 18, 1853, for the "direct application of the crank outside the hull to side-screw propellers combined with high-pressure engine." The first application under this patent was in 1855 to the side-wheel steamer Baltic, whose hull was 221 ft. by 30 ft. by 12 ft. depth of hold, with originally a high-pressure engine of 35-in. cylinder by 8 ft. stroke. In the place of this engine there were a pair of high-pressure engines of 26 in. by 36 in., fitted on each side of the vessel, to drive a screw propeller of about 13 ft. diameter. In 1856 Arthur Edwards, owner of the vessel, wrote to the designer of the machinery, in part: "She has not broken her machinery nor met with any accident during the whole time of two seasons. She now carries double the freight and runs with less than half the fuel, and at a much higher rate of speed. Notwithstanding her present engines rate 60 per cent. less power than her former engine, she now runs with 45 lbs. pressure of steam instead of 90 lbs. usually worked in her paddle-wheel engine. . . . The application of side propellers gives great deck room for carrying deck load and stability to the boat that is not obtained by any other means of propulsion. She has not damaged freight to the amount of one dollar for the last two seasons, yet she has experienced some of the heaviest gales upon our lakes, with heavy deck loads of freight and live stock." An engineer who was on the lakes at the time and knew the Baltic and her machinery very well, says: "The Baltic was a freighter; when running light was very fast, and when loaded was very slow." This would seem to be the result obtained in all four applications of this mode of propulsion. The next experiment along this line was on the Eureka, or Charlotte Vanderbilt, which ran on the Saugerties route on the Hudson river.

In 1864 Wright & Whitaker constructed the Com. Perry for the revenue cutter service on the lakes. The vessel was 166 ft. by 23 ft. 6 in. by 10 ft., with a draught of 6 ft. 6 in. There were two engines to each propeller wheel, of 18 in. diameter and 24 in. stroke each, and located about 12 ft. apart. The two propellers were each 13 ft. diameter and one-third submerged. Steam was furnished by two Whitaker drop-tube vertical boilers, 18 ft. by 9 ft., intended for a steam pressure of 90 lbs. One of the engineers who was on this vessel says: "When any sea was on one could not stand watch in the engine room, on account of the sea swashing over everything in the room, coming in by the way of the holes left for the cylinders and running out the lattice floor. Our ordinary cruising speed was 9 knots, yet I have driven her at a rate of 14 knots and 16 knots, but at the expense of a large consumption of fuel. The boilers were worked under a pressure of 120 lbs. to 150 lbs. steam at times. The vessel was thought only fit for a mill pond, as the operation of the engines was anything but comfortable." The noise from the four exhaust pipes with the four short exhausts from the engines was similar to the noise from the machinery of a saw mill. The vessel did

some good service on the lakes and was finally placed out of commission about 1880.

The steamboat Water Witch, built in 1861, and of 170 ft. length and 20 ft. beam, had a beam-propeller engine geared to the propeller shaft, fitted in the vessel by the Detroit Locomotive Works. The wheel was 9 ft. diameter by 18 ft. pitch, making 75 to 80 revolutions. The vessel was lost, in 1863, on Lake Huron. There had been four or five of this same type of engines built in New York just prior to this date.

The Detroit & Cleveland Steam Navigation Co. operated for two years, about 1850, two high-pressure steamboats, Southerner and Baltimore. The former was 170 ft. by 27 ft. 10 in. by 11 ft. 6 in., with an engine of 27 in. cylinder by 8 ft. stroke, and five boilers; and the latter was 169 ft. by 26 ft. by 11 ft. 4 in., with an engine of 24 in. cylinder by 8 ft. stroke, and five boilers. During 1852, other interests had the Forest City built for the route. She was of about the same size as the Southerner and Baltimore. The same year the St. Louis and the Samuel Ward were added to the service. The former was 185 ft. by 27 ft. by 12 ft. 6 in., with a low-pressure engine, 44 in. cylinder by 9 ft. stroke, and the latter 173 ft. by 25 ft. 6 in. by 9 ft. 4 in., with an engine of 40 in. by 10 ft. stroke. The Cleveland, built in 1852, was added the same year. She was 180 ft. by 28 ft. by 11 ft. 8 in., with an engine of 50 in. by 10 ft. The May Queen, built in 1853, and the Cleveland, were the only steamboats operated on this line until 1855, when the Ocean was added. From 1856 to 1862 the May Queen and the Ocean filled the service between the two cities; from 1864 to 1867 the City of Cleveland and the Morning Star were on the route; from 1867 the R. N. Rice, built that year, ran with the Northwest, until 1868, when the Detroit Steamship Co. was incorporated, and the same steamers ran until 1877, when the R. N. Rice was partially burned. The same year the company had built by Kirby Bros. their first iron-hull vessel, the City of Detroit No. 1, the hull being 250 ft. by 35 ft. by 14 ft. 6 in., with a beam engine of 62 in. by 11 ft. stroke. This steamer with the Northwest covered this route until 1883. The City of Cleveland, a duplicate of Detroit No. 1, was built in 1880 and ran on the Mackinac route until the City of Mackinac was completed, in 1883. After this vessel was in service one year her engine was compounded by the W. & A. Fletcher Co. of New York. A high-pressure cylinder was added just in the rear of the low-pressure cylinder and connected through its piston to the same end of the beam. In 1889 the City of Detroit No. 2 was constructed of steel. She was the largest vessel of the fleet at that time and had all the improvements. Since then there have been added the City of Alpena and City of Mackinac, both constructed in 1893 at Wyandotte, Mich., of steel, having compound beam engines and costing over \$300,000 each. These were built to take the place of steamers of the same name that were sold to the Cleveland & Buffalo Transit Co.

They were not so progressive in the introduction of iron-hull vessels on the lakes as they were on the Atlantic coast, for it was not until 1861 that David Bell of Buffalo constructed the screw steamer Merchant for Lake Erie service. This industry did not show a healthy growth until 1871, when the King Iron Works, successors of the Shepherd Iron Works, built four screw steamers for the Anchor Line, and about the same time the Wyandotte yard of the Detroit Dry Dock Co. built the E. B. Ward. Since 1860 iron ship building on Lake Erie and Lake Michigan has made marvelous strides, and some of the vessels constructed there in the last few years have been for Atlantic coast service being sent through the Canadian canals to the coast, in some cases in sections. These vessels have proved a credit to their builders.

NAVIGATION ON LAKE ONTARIO.

On Lake Ontario a grant was obtained in 1815 from the representatives of Robert Fulton and his associates, who held the exclusive right, under the legislative grant, to steamboat navigation on the waters of the state of New York, for the right to navigate this body of water. The Ontario was built at Sacketts Harbor, N. Y., in 1816, and commenced to run between Ogdensburg and Lewiston early in the season of the next year. The vessel was 112 ft. long, 28 ft. beam and 8 ft. 3 in. depth of hold. She was fitted with masts and sails as vessels of that period. The engine was a lever-beam, built by Daniel Dod, Elizabethtown, N. J., having a 34-in. cylinder and 4 ft. stroke, the castings being furnished by Robert McQueen of New York city. Steam was furnished by two single-flue boilers. After the original engine had done service for twelve years it was removed, and one built by S. Sexton, low-pressure of 28 H. P. substituted. The vessel was broken up about 1835.

The Sophia was built the year after the Ontario. The boat was smaller than her predecessor, being of but 50 tons. She was 67 ft. 8 in. long by 18 ft. 2 in. beam by 4 ft. 7 in. hold, and was built at Sacketts Harbor by A. S. Roberts for E. Camp & Co., the owners of the Ontario. She had a low-pressure engine, built by James P. Allaire of New York. The next steam vessel was the Martha Ogden of 49 tons, built at Sacketts Harbor in 1823 by A. S. Roberts for L. Ogden & Co. She was 74 ft. 3 in. by 17 ft. 10 in. by 4 ft. 2 in.; and was also fitted with one of James P. Allaire's low-pressure engines, of 22 H. P. This steamboat continued in service until 1832 when she went ashore and was lost for further use. In 1831 the Brownville was built for D. Griffen & Co. She was 85 ft. 10 in. by 20 ft. by 7 ft. 4 in. and was fitted with a low-pressure engine. In the same year the Charles Carroll was built at Sacketts Harbor by C. Carr for the same parties that owned the Brownville. She was 81 ft. 8 in. by 14 ft. 6 in. by 6 ft. 3 in., and was fitted with a low-pressure engine.

built by J. Dod. In the next year the William Avery was also built at Sacketts Harbor by the same builder and for the same parties, and was 131 ft. by 21 ft. by 7 ft. 4 in. She was also fitted with a low-pressure engine. All these vessels were used to ply to and from Sacketts Harbor and the lake ports.

The United States was built at Oswegatchie in 1831 by William Capes for the Ontario & St. Lawrence Steamboat Co. She has 143 ft. by 26 ft. 7 in. by 11 ft., and was fitted with a low-pressure engine, 40 in. cylinder by 8 ft. stroke, built by W. Avery & Co. This vessel continued in service until 1843, when she was broken up at Oswego, her engine being put in the Rochester. This vessel was not used on the St. Lawrence river after the "Patriot War" of 1837, as she took a part in that affair, and having become obnoxious to the Canadians it was not considered advisable to use her on that part of the route. This company was incorporated by the New York legislature in January, 1831, with a capital of \$100,000, and the United States was its first vessel. For size and accommodations she far surpassed anything that had previously been in service on Lake Ontario. In 1833 the Black Hawk was built at French Creek by G. S. Weeks for William Baker & Co., for use on the St. Lawrence river. This vessel was 106 ft. by 18 ft. by 17 ft., and was fitted with a low-pressure engine of 30 H. P. The Oswego, for Lake Ontario service, was built in 1833 at Oswego; was 143 ft. by 20 ft. by 7 ft. 8 in. Her low-pressure engine, built by Avery & Co., was transferred in 1839 to the St. Lawrence. In 1835 the Oneida was built at Oswego. She was 132 ft. by 19 ft. by 9 ft., had a low-pressure engine and was commanded by one of her owners. Some years later she was on Lake Erie, where she was finally lost. There was also on the river the Telegraph of 131 ft. by 18 ft. 9 in. by 8 ft. She was converted into a sailing vessel and destroyed by fire on Lake St. Clair. There was a small boat of 68 ft. length, built for Black Lake, named *Rossie*, having a high-pressure engine built by Starbuck & Son, Troy, N. Y.

In 1839 the St. Lawrence was built at Oswego. In 1844 this vessel was rebuilt and lengthened so that she measured 180 ft. by 23 ft. by about 11 ft. She was in service about five years and was laid up at Clayton, N. Y., in 1850. The engine came out of the Oswego. In 1842 the American Line on Lake Ontario, running from Lewiston to Ogdensburg, stopping at Toronto and Kingston on the Canadian shore, and Rochester, Oswego and Sacketts Harbor on the American shore, had four steamboats in operation. They were the Rochester, which was 158 ft. by 27 ft. by 11 ft., with high-pressure engine, 28 in. by 8 ft.; Lady of the Lake of about the same size; the Oneida, built in 1835, and the St. Lawrence. The time consumed for the trip from Ogdensburg to Lewiston was twenty-four to twenty-six hours.

In 1849 the United States Mail Line, or American Steamboat Co., and in 1859 the Ontario Steamboat Co. had the Northerner, the Ontario and the Bay State. The Ontario was 222 ft. by 32 ft. by 12 ft., with a beam engine of 50 in. by 11 ft. The Northerner was 200 ft. by 37 ft. by 12 ft., with a beam engine of 60 in. by 11 ft.; and Bay State, 200 ft. by 27 ft. by 10 ft., with beam engine of 40 in. by 11 ft. The New York was added in 1852. She was 223 ft. by 33 ft. by 12 ft. with beam engine, 60 in. by 12 ft. The building of railroads along the lake destroyed the business of this line in the same way and about the same time—a few years later—that it caused the withdrawal from active service of the large side-wheelers on Lake Erie, but with the difference that while the Lake Erie vessels had their engines removed and mostly sent to New York city, to be used in other vessels, the Lake Ontario vessels had in the St. Lawrence river, notwithstanding its rapids, an outlet by which they could reach American ports on the Atlantic seaboard. In 1860 the New York and the Northerner and in 1863 the Suffolk and Bay State, and in 1865 the Ontario, were all taken safely down the St. Lawrence to ports on the Atlantic coast. The New York saw considerable service on the New England coast and on the Delaware river and bay and was laid aside from further service about 1893. The Ontario and the Bay State were sold to foreigners about 1867. Most of the engines for these vessels were built at the Morgan Iron Works, New York city. Some months prior to the New York running the rapids in 1860 two Canadian built side-wheel steamboats that were larger than the New York attained the same distinction. The Canadian steamers were 298 by 30 by 9 ft. They were named originally *America* and *Canada*. There was American capital invested in their construction by the Great Western Railroad Co. They had beam engines of 70 in. by 12 ft., constructed by H. R. Dunham & Co. After they arrived in New York they were altered for coast service—for they were much like our Long Island Sound steamboats—by cutting off part of their guards to 3 ft. in width, and building up the structure on the main deck more solid and firmly, and by adding heavy hog frames to enable them to withstand the severe weather encountered on the coast. One of these vessels was chartered to the quartermaster's department to transport troops. Her name changed to *Coatzacoalcas*. It has been an enigma how this vessel, so ill-adapted to this work, could have gone through the many trying situations in which she was often placed without greater damage than she received. A special act of congress was obtained to give her American register. Her charters to the government ran from March 16, 1861, to Sept. 17, 1862, at from \$1,100 to \$1,400 per day. After the vessel was placed on the Nicaragua route, where she remained until 1866, her name having been changed to the original one of *America*, she was rebuilt, her bottom being planked over the original hull, with strengthening of bulkheads and hull in general. She was then sent around to the Pacific ocean, and came near being lost on the voyage. She

was finally destroyed by fire while lying in the harbor of San Juan del Sur, Nicaragua, April 11, 1869. The *Canada* was purchased by Hargous & Co., renamed the *Mississippi*, and placed on their Tehuantepec route from New Orleans for a year or more. History seems to have swallowed up her record after this, though it is thought she was sold for service in South American waters, from Panama to Valparaiso. Marshall O. Roberts of New York was interested in these vessels.

STORY OF HOW THE RAPIDS WERE RUN.

An account is thus given of the *America* and the *Canada* running the rapids of the St. Lawrence: "The fine steamers *Canada* and *America* have been brought safely down the rapids of the St. Lawrence to the ocean. They cost half a million dollars, and were found to be worth nothing above the rapids. In passing down the rapids they made some leaps 7 or 8 ft. in height. For vessels 300 ft. long and 6 or 8 ft. draught this was regarded as a neck or nothing experiment. The first rapids—the Long Sault—are 7 miles long and extremely rough, the boiling water heaving up from 8 to 12 ft. high in places and dashing about the rocks like the ocean in a violent storm. This passage was made in fifteen minutes. The rapids of Split Rock were next in the way. Here it was necessary to make a curve almost at right angles within a space only two-thirds the length of the same. The pilot, in the Long Sault rapids, with the dexterity of a skillful player at billiards making his carom, let the bow of the boat strike a rock forcibly on her starboard side, thereby throwing her stern into the center of the channel by the only practical method, and permitting her to pass through in safety. Next the Cedar rapids were reached. They were passed at the same rate, the boat striking alike aft and forward, but no substantial injury was sustained. The Lachine rapids, near Montreal, were the next. Here the *Canada* again struck. The rocks here are exceedingly bold and present a rough and ragged surface, but were passed in safety, and in a short time the vessel and her bold mariners glided placidly and exultingly through the abutments of the Victoria bridge."

There was no further running of these rapids by American vessels, or those for use on our coast, until June, 1891, when the whaleback *Colby* shot the rapids of the St. Lawrence, on her way from Duluth, Minn., to the Atlantic coast. This vessel was 250 ft. by 36 ft. by 22 ft., and drew 6 ft. 9 in. aft and 5 ft. 6 in. forward. The first running of these rapids by American steamers was by two revenue cutters, about 1848 or 1850, named the *Jefferson* and the *Dallas*.

Since 1870 more than one attempt has been made to establish an American line on the St. Lawrence river for the summer travel exclusively, but they have all ended in a failure.

LOSS OF LIFE ON THE GREAT LAKES.

During the season of navigation just closed on the great lakes ninety-four lives were lost. Of this number ten were passengers, being the first passengers to be lost for over a decade. The total number of lives lost is the smallest since 1896. In but a single case was a vessel lost with her entire crew, the foundering of the schooner *Emerald* on Lake Ontario in November being the exception. While the loss of property was the heaviest for five years the crews of the wrecked vessels were generally taken off in the life boats. Singularly enough the wrecks were not caused by the heavy gales but by the more moderate ones. By causes, the losses were as follows: Overboard, forty-one; fell into hold, eleven; foundering, twenty-three; collision, five; killed by machinery, ten; fell from mast, two; fire, one; shot by mistake, one.

Divided by lakes, Lake Erie leads with twenty-nine fatalities. Lake Michigan is next with twenty-six. The others were: Lake Ontario, fourteen; Lake Superior, eight; Detroit river, three; St. Clair river, four; Lake Huron, ten. Compared with other seasons, the record is: 1896, sixty-six; 1897, eighty-eight; 1898, ninety-five; 1899, 100; 1900, 110; 1901, 122; 1902, 140; 1903, ninety-four.

In the number of lives lost, the foundering of the steamer *Erie L. Hackley* on Green bay, Oct. 4, was the most notable, in that twelve people went down, ten of them passengers. This disaster was caused by a tornado, which swept Green bay after doing a vast amount of destruction on land. The foundering of the big wooden steamer *W. F. Sauber* on Lake Superior, Oct. 26, the most important in a money way of all the disasters of the season, would have been attended by the loss of the entire crew had it not been for the heroism of Capt. James Johnson of the steamer *Yale*, who stood by the sinking boat all night through the storm and unassisted rescued all but two of her crew.

Capt. Albert Clinton, superintendent of the Detroit, Belle Isle & Windsor Ferry Co., died at his home in Windsor last week. He was born near Tilsburg, Ont., in 1843. While he was still a boy his parents moved to Belle Isle, then known as Hog island. He followed the lakes as a calling, his first command being the steamer *Minnie*, owned and operated by the Peninsula Iron Co. Later he became captain of the tug *Doyle*, owned by the Brown Dredging Co. In 1873 he entered the service of the Detroit, Belle Isle & Windsor Ferry Co. as master of the steamer *Hope*. Ten years later he became master of the steamer *Fortune*, and in 1893 he became superintendent. He is survived by a widow and daughter.

PROTEST AGAINST POOR LIGHTHOUSE SERVICE.

Editor Marine Review: It is an outrage to the shipping of Lake Superior and a reflection upon the lighthouse establishment of the United States government that the lights and fog signals of Lake Superior should be discontinued about Nov. 25. With great numbers of ships sailing this lake the first intimation we have of discontinuance of the lights is to see keepers walking the streets. Of course they are not to be blamed, as they would be willing to remain until the last of the vessels are laid up if assured that they would be taken ashore in a good boat at the end of their longer season. In one of the "Notices to Mariners" issued by the hydrographic office we find the announcement that the branch hydrographic office at Duluth reports that the lights at Menagerie and Passage islands, Lake Superior, were discontinued for the season of navigation on Nov. 25, 1903. Side-by-side with this is another announcement from a government that makes no pretensions of greatness on the lakes. Note this from Ottawa: "The deputy minister of marine and fisheries gives notice that owing to representations having reached his department urging the maintenance of the lights on the upper lakes and rivers later than usual this year, instructions have been issued to all light-keepers in the Canadian government employ to keep their lights in operation as long as any navigation is possible within sight of them. The only exceptions are the lights on the north shore of Lake Superior. Arrangements have been made to take the light-keepers away from these stations after Dec. 1, 1903. In future years efforts will be made to retain the keepers at the light stations until after navigation is closed."

Everybody knows that of late years, with our modern steel vessels, there is no thought of quitting Lake Superior until Dec. 10 or Dec. 15, and that in most seasons navigation might be continued still later. What a reflection it is upon the lighthouse officials that they make no effort to improve upon their old (before the war) methods; that in the most important part of the year, when western products are being rushed to market, they shut off lights and fog signals, the latter especially on account of the need of them in snow storms. It is a wonder that the commercial organizations have so long put up with the very poor service of this lighthouse organization. We see enough reports of appropriations from congress for tenders for them but the vessels do not seem to materialize. The right kind of effort in Washington on the part of vessel masters and vessel owners should provide a tender for Lake Superior that will look after the interests of this lake in the summer and at this time of year provide for the light-keepers—a service of more advantage than dress parade around Detroit.

ALEXANDER McDUGAL.

Duluth, Dec. 10, 1903.

STORM TOO SEVERE FOR HACKLEY'S CLASS.

When the steamer *Erie L. Hackley*, a small passenger and freight vessel, foundered with a loss of several lives on Green bay some weeks ago, Mr. Geo. Uhler, supervising inspector-general of steam vessels, evidently concluded that he would personally look into the cause of the disaster, as he attended the government investigation that followed. Asked as to the conclusion, Mr. Uhler replied as follows:

"In company with C. H. Westcott, supervising inspector of the eighth district, I proceeded to Sturgeon Bay, and attended the investigation held by Capt. Westcott at Sturgeon Bay, where there were examined several witnesses, among them being fishermen, caulkers, machinists, boiler makers and others, all of whom testified as to the condition of the steamer, the weather, and the perils of the route she was navigating, and the conclusion was arrived at that the tornado that struck the *Hackley* would in all probability have encompassed the destruction of any steamer of the *Hackley's* class."

CONSOLIDATED LAKE SUPERIOR SOLD FOR \$4,500,000.

Practically all the assets of the Consolidated Lake Superior Co., consisting of the collateral pledged with the banking house of Speyer & Co. to secure the loan of \$5,500,000 obtained by the company when its financial difficulties first became acute, were sold at auction in New York on Tuesday to a representative of the banking house. Among those present were James Speyer and Charles H. Tweed, of Speyer & Co., and E. C. Henderson of Guthrie, Cravath & Henderson, counsel to that firm; Francis H. Clergue, who was the promoter of the company and its president at one time; Charles E. Orvis, one of the company's directors, and Mr. Hay, a director of the Imperial Bank of Canada. Several protests made by interests that objected to the auction were read. Then the property was put up and Mr. Henderson's bid of \$4,500,000 was the only one. It was stated that Mr. Henderson was buying the property for the participants in the loan agreement of Dec. 23, 1902, that is, for members of the Speyer syndicate. Later in the day Speyer & Co. made this statement:

"Speyer & Co. announce that, having purchased for the participants in the advances under the agreement of Dec. 23, 1902, the security for the loan to the Consolidated Lake Superior Co., which matured on June 30, 1903, they are requesting authority from the participants in the loan to admit the Consolidated Lake Superior Co.'s stockholders to an interest in the liquidation of the security or the reorganization of the properties. It is anticipated that the stockholders' contribution would be about \$3 per share."

AROUND THE GREAT LAKES.

The steamer *S. S. Curry*, which struck at the Lime-Kiln crossing, had twelve plates damaged. She was docked at West Superior.

The steamer *J. J. Albright*, which struck an obstruction in Duluth harbor, was docked at Lorain this week. She will require ten new plates.

The steamer *L. C. Smith*, which was the last vessel to load grain at the head of the lakes, arrived in Buffalo on Monday of this week where she will winter.

The cable to be laid across Death's door, connecting Washington and Plump islands with the mainland, has arrived at Sturgeon Bay. It is expected to be laid next spring.

Joseph Hayes, chief engineer of the Pittsburgh Steamship Co., Capt. W. W. Smith, marine superintendent of the fleet, and Capt. Joseph Kidd of the same line are now engaged in making a tour of inspection of the vessels of the company.

James Larson, owner and master of the schooner *Three Sisters*, has purchased the material for a small steamer to be constructed during the winter. The vessel will be used in the freight business on Green Bay next season and for fishing during the fall and winter.

The new life-saving station at the mouth of the Chicago river was completed last week and turned over to the life-saving service. It was accepted on behalf of the government by Lieut. Reinberg, in charge of the district. The new station is said to be the best and most modern in every way in the United States.

Considerable opposition has developed to the plan for the discontinuance of the lighthouse at North point (Milwaukee) and the order may not go into effect. The board of directions of the Milwaukee Chamber of Commerce adopted a resolution asking that lighthouse board to rescind the order to discontinue the light on Dec. 30.

Mr. William Livingstone, president of the Lake Carriers' Association and Mr. Harvey D. Goulder, counsel, left for Washington this week to appeal to congress for the lowering of the tunnels in the Chicago river. These tunnels are an obstruction to navigation and seriously interfere with the movement of vessels in the river.

A dispatch from Chicago announces that rush orders have been issued for the completion of the big ship canal to connect East Chicago and Indiana Harbor, Ind. The waterway will consume over two years in building but it is planned to have part of the canal open to lake steamers by next summer. It is announced that material has been ordered for two large dredges of the suction type.

Four tugs, the *General Protector*, *Home Rule* and *Harvey D. Goulder*, engaged in an exciting race through 6-in. ice last week from Amherstburg to Point au Pelee for the tow of the steamer *Weston* and her two barges. It was one of the incidents of the war between the Hackett Wrecking Co. and the Great Lakes Towing Co. The rivals *General* and *Protector* led the race. The towing company got the job.

Capt. John Sweeney of the barge *Crete*, who, it is said, had the honor of being the first pilot of the Masters & Pilots' association, died a few days ago at the home of his brother, James Sweeney, at Delray, Mich. He was formerly mate of the steamer *Iroquois*. Several years ago he became a victim of consumption and was ordered south for his health. He spent some time in New Mexico but returned about six months ago.

Capt. James Corrigan of Cleveland has abandoned the steamer *J. Emory Owen*, burned at Sturgeon Bay, to the underwriters as a constructive total loss. The steamer was insured for about \$70,000 in companies represented by Smith, Davis & Co. of Buffalo. It is reported that her machinery is merely a mass of scrap iron. Sixteen thousand bushels of dry oats was saved out of the vessel's cargo. The damaged portion of the cargo has been sold to the Krause Co. at Milwaukee.

M. K. Cowan, M. P., Windsor, will endeavor to have the Dominion government install the Marconi system of wireless telegraphy between Pelee island and the mainland. The government laid a cable to the island some years ago, but it has never given satisfaction, and the repeated partings of the cable have cut the islanders off from communication with the mainland during the winter months. Hon. James Sutherland, minister of public works, has promised to look into the matter for Mr. Cowan and give a reply at an early date.

If not a perilous at least a very cold trip is being undertaken now by the car ferries *Pere Marquette No. 16* and *Pere Marquette No. 20*. They both left Cleveland shortly before midnight Monday night for Lake Michigan. *Pere Marquette No. 16* is returning from her station at Conneaut and *Pere Marquette No. 20* was just completed at Cleveland. She will be operated between Milwaukee and Ludington. *Pere Marquette No. 20* is being taken up the lakes by Capt. U. S. Colby, but she will be commanded on her regular run by Capt. Ackerman.

The new Canadian Pacific steamer *Princess Beatrice* for the British Columbia northern route will be commanded by Capt. Hickey, late of the *Yosemite*. Her dimensions are: Length, 202 ft. over all; breadth, 37 ft.; depth 25 ft. 6 in. from upper deck. She has a wooden hull with steel bulkheads and is fitted with triple expansion engines of 1,000 H. P. capable of making 13 knots an hour. She has accommodation for 150 passengers, is lighted by electricity and heated by steam.

James Whalen of Port Arthur, Ont., is having a marine railway built at that place.

SHIP BUILDING ON THE CLYDE.

Orders for Five More Turbine Steamers—Complaint Regarding New Mail Contract—England Buys Chilean Ironclads.

Glasgow, Dec. 7.—The contract for the second of the two turbine steamers for the Allan Line's Canadian service has now been placed with Alex. Stephen & Sons, Glasgow. This new vessel will be a sister ship to the Victorian, now under construction in the yard of Workman, Clark & Co., Belfast, and already described. Both vessels will be larger and considerably faster than the Bavarian and the Tunisian, at present the largest and fastest steamers in the Canadian trade. In addition to this turbine, Wm. Denny & Brothers, Dumbarton, have booked orders for four turbine steamers besides that for the Union Co. of New Zealand. The vessels are all for Colonial owners, and will be of very much the same size as the Union Co.'s steamer.

It is evident that the statistics of Scottish shipbuilding for 1903 will be far below 1902. The eleven months' figures now show a decrease in Scotland of 88,526 tons, and on the Clyde of 80,126 tons. December will not wipe off this difference, nor will the industry be characterised by much activity for some time to come. The contracts during November would have been insignificant but for five turbine steamers placed, and there seems little prospect of new work for regular cargo carrying lines. The yards which do admiralty work are now slackening off, and the paid-off list of workers increases. The labor world (except at Dundee, where the engineers are squabbling) is meanwhile quiet.

Scotch launches during November were twenty-one vessels of 29,219 tons, as compared with twenty-two vessels of 45,819 tons in October, and with thirty-two vessels of 48,549 tons in November of last year. To the total the Clyde contributed seventeen vessels of 26,471 tons, the Forth one vessel of 1,513 tons, and the Tay three vessels of 1,235 tons.

There are in the list of November vessels an unusually large number of dredgers and barges. Of other vessels three are twin-screw steamers and nine are single-screw. There are no sailing vessels, fishers or yachts. Of the vessels one was over 6,000 tons, two between 4,000 and 5,000, two between 2,000 and 3,000, four between 1,000 and 2,000, three between 500 and 1,000, and nine between 100 and 500 tons. Of the total tonnage 2,210 tons are for Egypt, 1,513 for Spain, 1,000 for South Africa, 140 tons for South America and the rest for British owners.

The following were the most notable items put into the water: Marathon, a twin-screw steamer of 6,770 tons, with engines of 1,225 horse power, built by Alexander Stephen & Sons for George Thompson & Co., Aberdeen and London; Tweeddale, screw steamer of 4,100 tons with triple expansion engines of 1,800 I. H. P. by David Rowan & Co., built by Russell & Co., for Glasgow owners; Volga, screw steamer of 4,000 tons, with triple expansion engines of 1,700 I. H. P. by Rankin & Blackmore, built by Russell & Co., Port Glasgow, for Glasgow owners; Chinua and Linan, twin-screw steamers of 2,198 tons with engines of 1,500 I. H. P., built and engined by Scott & Co., Greenock, for the China Navigation Co.; Cabo Corono, screw steamer of 1,513 tons, with engines of 850 I. H. P. by Blair & Co., Stockton on Tees, built by the Grangemouth & Greenock Dock Yard Co., Grangemouth, for Seville; Princess Patricia, screw steamer of 837 tons with triple expansion engines of 1,200 I. H. P., built and engined by the Caledon Ship Building & Engineering Co., Dundee, for Glasgow and Liverpool coasting trade; Thelma, screw steamer of 375 tons, with engines of 350 I. H. P. by Ross & Duncan, Govan, built by the Ailsa Ship Building Co., Ayr, for Warrington owners; Levant, cable-repairing steamer of about 300 tons, with engines by Muir & Houston, built by George Brown & Co., Greenock, for the Eastern Telegraph Co., London; Yurimaguas, screw steamer of 140 tons, with engines of 300 I. H. P., built by Murdoch & Murray, Port Glasgow, for service on the Amazon; Neptune and Rhameses, sand pump dredgers of 1,105 tons, with engines of 1,000 I. H. P., built and engined by Lobnitz & Co., for the Campagnie Universelle du Canal Suez, Port Said; Duiker, twin-screw suction hopper dredger of 1,000 tons with engines of 1,000 I. H. P., built and engined by Fleming & Ferguson, for the government of Cape Colony; hopper, No. 23 twin-screw hopper steamer of 230 tons gross and 1,200 tons carrying capacity, with engines of 1,400 I. H. P., built and engined by Fleming & Ferguson for the Clyde Navigation Trustees; Craigichall, twin-screw barge loading bucket ladder dredger of about 750 tons gross and 1,080 tons deadweight, with two sets of three-cylinder three-crank compound surface-condensing engines of 1,400 I. H. P., built and engined by Wm. Simons & Co. for the Clyde Navigation Trustees; four barges of about 400 tons each, built by D. & W. Henderson & Co. for shipment to the far east.

The most important of the new orders announced in November were for five turbine steamers. Wm. Denny & Bros., Dumbarton, are as said above to build four for Colonial owners, and Alex. Stephen & Sons, one of over 12,000 tons for the Allan Line. The sizes of the new Dumbarton turbines have not been stated, but they will resemble the turbine steamer which the firm are already building for the Union Co. of New Zealand. Robert Duncan & Co., Port Glasgow, are to build two fairly large steamers for the Lyle Shipping Co., Greenock; and Mackie & Thomson, Govan, a steamer to carry about 870 tons for the Main Colliery Co., Bristol. The total of new tonnage booked is about 40,000 tons.

QUESTION OF MAILS.

Probably as much interest is being taken on your side as here in the new contest with the Anglo-American mails. Present ex-

periences will make it a difficult matter for the postmaster-general of the United States to defend the new policy as to the conveyance of the Saturday mails from New York to Britain. For many years these mails have been carried by the Cunarders, the liners of that company which sailed on the Saturdays being the fastest on the Atlantic route. When the American Line, about a month ago, altered their day of sailing from Wednesday to Saturday, it was announced that the American mails would in future be given to the St. Louis and her sister ships, on the ground that as these steamers sailed direct to Southampton, a saving of two days would be effected. But this is not the case. At the first trial, when the Philadelphia carried the mails which would have gone by the Etruria, the bulk of the letters by way of Southampton and the letters by way of Liverpool reached London about the same time. On the following week with the Campania and the St. Louis, a similar result occurred. Although the Cunarder, by waiting for the Australian mails, did not get away from New York till 5 p. m. on the 14th, six hours after the American liner, she reached Queenstown at 3:20 p. m. on Friday the 20th and Liverpool in the early hours of Saturday morning, enabling her Australian and specially marked American correspondence to reach London in time to be included in the 12:15 p. m. delivery of that day. The St. Louis, with a half-dozen hours' start, reached Southampton at 6:40 a. m. on Saturday, but her mails did not get to London till 10:34 a. m., and were sent out along with those brought by the Cunarder. Last week both the Umbria and the New York arrived at Liverpool and Southampton respectively too late on Saturday night to allow of any distribution of letters that day. In each case the Cunarders were handicapped by the want of a special train at Queenstown for the conveyance of the special mails they carried. Had such a train been provided, as was always done under the old arrangement, the letters by the Queenstown-Liverpool route would have reached their destinations much more speedily than they did. Those brought by the Campania might have been delivered in London by the early morning delivery of the 21st, and replies could have been sent to the United States by the outgoing mail of the same day. The letters were distributed in Glasgow at 3:30 p. m. but if there had been a postal special train an earlier delivery could have been made, and answers returned by the American mail which closes here at 1:15 p. m. on Saturdays. The American Line is now proposing to land the Saturday's mails at Plymouth instead of Southampton, and in this way expedite delivery in London. Meanwhile the British public has not gained by the change made by your postmaster-general.

I have referred in previous letters to the shipping projects of the Canadian Pacific Railway Co. as they are disclosed here. They are now about to establish a new European service, started with a steamer to be despatched fortnightly from London to St. John, New Brunswick, via Antwerp. The service is to be confined to freight traffic for the present, and will compete principally with the American Line. Since the C. P. R. acquired, six months ago, the ships of the Elder-Dempster group for the purpose of opening up European connections, they have started a fortnightly passenger and freight service from London and Bristol to St. John; and a service between New Orleans and England in the cotton trade. The London and New Brunswick line will thus be their fourth new service within six months.

Two ironclads ordered by Chili when on the verge of war with Argentina, but which cannot be made use of on account of the terms of peace, have been purchased by the admiralty for the British navy. One of them, the Chilean battleship Libertad, which was built, engined, and armed by Vickers, Sons & Maxim, Barrow-in-Furness, has been having her speed tests here. The other vessel, named Constitution, was built by the Armstrong-Whitworth Co. and is now on the Tyne. The price of the two ships is £1,875,000. When the admiralty previously declined to buy the price asked was £2,200,000.

WE MUST HAVE SHIPS.

Forty years ago we had only one-fourth as much foreign commerce to transport as we have now, yet we actually carried in American bottoms forty years ago three times as much foreign commerce as we carry today.

The United States will never attain its full dignity as a commercial nation until it develops an ocean mercantile marine commensurate with the dimensions of its enormous foreign trade. To surrender that trade into the hands of ship owners of other countries is absurdly incongruous with our enterprise as a people, and at humiliating variance with our procedure when, as a young, weak power, we furnished ships for a large portion of the business done by the world on the ocean. If that highly creditable result can be again brought about through a well-devised subsidy system, no American who takes pride in the national prestige will begrudge the money thus spent, for every dollar of which the country at large will get a rich return. The country, progressive and alert in all other directions and keenly alive to the value of protection for its manifold home interests, has utterly neglected the needs of its mercantile marine and allowed its ocean carrying trade to be almost completely monopolized by the vessels of other countries, which reap a rich reward in the millions of dollars paid by us for freight and passage, nearly every dollar of which goes and remains abroad. This short-sighted policy is entirely at variance with the shrewdness in business affairs generally for which the American people are proverbial.—Troy (N. Y.) Times.

STATE OF AMERICAN SHIPPING.

In the issue of the Review of June 18 last it was noted that the Maritime Association of the Port of New York had appointed a committee, after a considerable amount of discussion, to investigate the subject of American shipping in the foreign carrying trade and to draft such a bill as, in the judgment of the committee, would affect the upbuilding of American ocean-going shipping. This committee, consisting of Messrs. A. A. Raven, Ernest C. Bliss, Fields S. Pendleton, Henry E. Nesmith and Wallace Downey, reported their findings last week to the association and asked for further time as follows:

1. We find that, despite the quadrupling of our foreign commerce, our tonnage register has declined from 2,496,894 tons in 1861 to 873,235 tons in 1902; and that while American vessels carried 72.1 per cent. of our exports in 1861 they carried but 6.6 per cent. in 1902.

2. This discloses such a remarkable decline in American shipping engaging in ocean trade, during a period of unparalleled development and prosperity throughout the United States, as to necessitate a far more thorough and detailed examination into its causes than we have yet been able to devote to it, as no effective measure of relief can be framed until the causes that have produced existing conditions have been completely uncovered.

3. Our investigation has been undertaken at a time when American ship building is in a state of unprecedented stagnation, when not a single new steamship has been contracted for in an American ship yard for nearly three years, when many of our most modern and best equipped ship yards have been and still are involved in serious financial difficulties, threatening the loss of many millions of dollars that have been invested in a great American industry the healthy and prosperous condition of which is essential to the independence and safety of the nation.

4. The United States is lacking in none of the essentials for successful ship building. We possess mines of iron ore and coal of unequalled richness and extent, forests of the finest timber, steel and lumber mills in great abundance, naval architects and marine engineers of world-wide fame and skill equal to the best to be found elsewhere, an abundance of intelligent labor, exports of greater magnitude and value than those of any other nation, together with resources and wealth second to those of no other nation.

5. We find that American vessels engaging in our ocean trade are today compelled to meet a more serious and a more destructive competition than ever before, largely through the vast subsidies and bounties that foreign governments are now paying to their merchant ships. We realize that the purposes for which these subsidies and bounties are paid to their merchant ships by foreign governments are chiefly military—in order that there shall be available auxiliary cruisers, scouts, transports, colliers, supply ships, and such other vessels, with their trained and experienced officers and men, as are essential to the uses of the government in time of war. And we further realize that

the unprecedentedly low freight rates resulting from these subsidies and bounties received by foreign merchant ships render successful and profitable competition on the part of unprotected vessels built in the United States and officered and manned by our own citizens, absolutely impossible.

6. The feeble and declining condition of our merchant shipping in the foreign carrying trade, and the steady growth and prosperity of the foreign shipping that competes with our vessels, discloses a perilously weak condition in one of the industries that is an essential arm of the national defense, coincident with the strengthening of that resource of the national defenses of our rivals. This is a condition that cannot be perpetuated without menacing the safety of the United States.

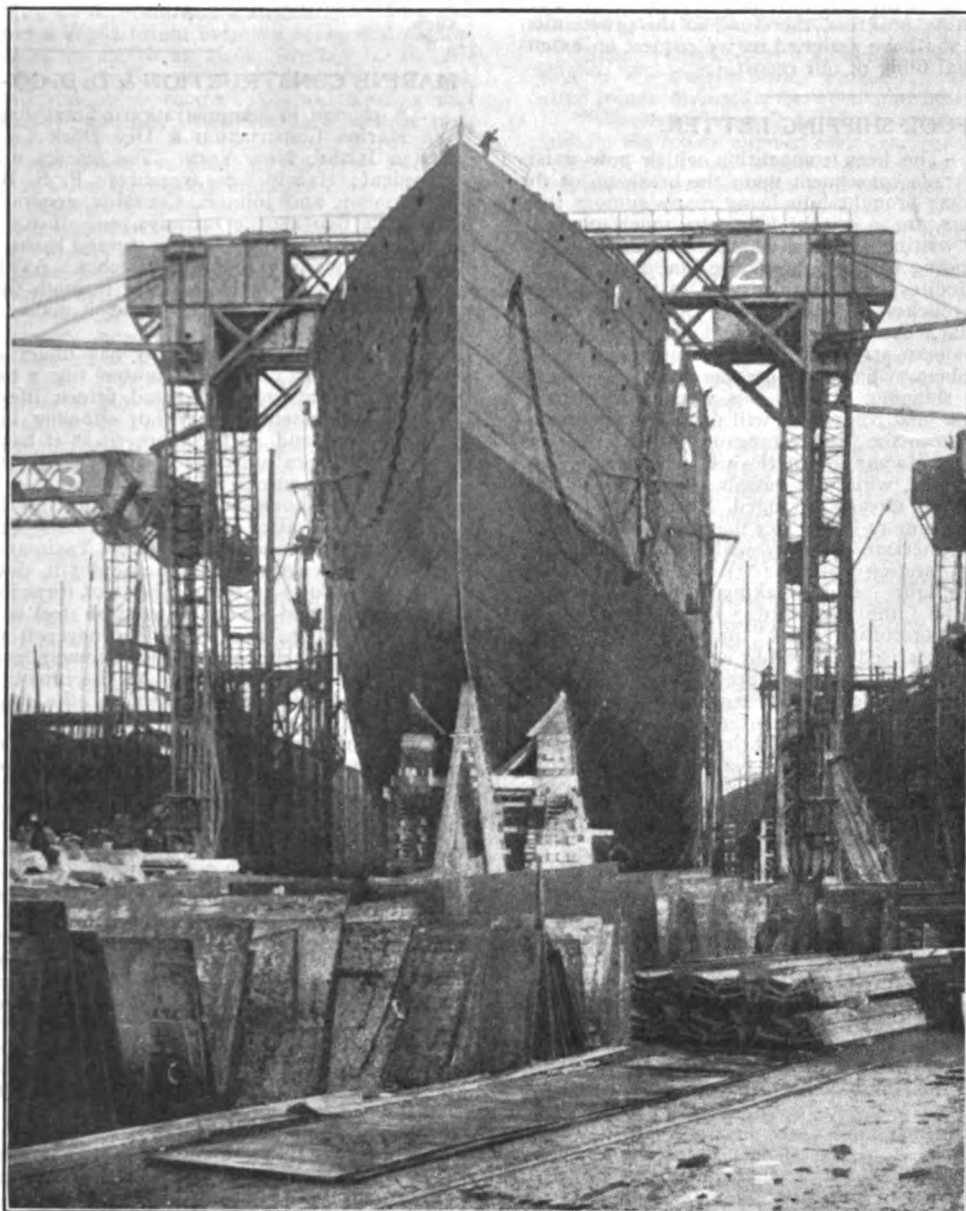
7. In his annual message to congress President Roosevelt recommends the appointment of a great commission to investigate our ocean-going shipping and to report to congress at its next session. The president recommends the inclusion of the secretary of the navy, the postmaster-general and the secretary of commerce and labor, in any commission that congress may provide for. This suggestion recalls the fact that in 1791 congress in-

vited Thomas Jefferson, then secretary of state in President Washington's cabinet, to prepare a "Report on the Privileges and Restrictions of the Commerce of the United States," which report was not made public until Dec. 16, 1793—just 110 years ago. "As a branch of industry," said Jefferson in that report, speaking of our shipping, "it is valuable, but as a resource of defense, essential." He also uttered the following remarkable warning, at a time when American ships carried 82 per cent. of our imports and 77 per cent. of our exports, prophetic of conditions as they exist today. He said:

"If particular nations grasp at undue shares of our commerce and more especially if they seize on the means of the United States to convert them into aliment for their own strength and withdraw them entirely from the support of those to whom they belong, defensive and protective measures become necessary on the part of the nation whose maritime resources are thus invaded, or it will be disarmed of its defense; its productions will be at the mercy of the nation which has possessed itself exclusively of the means of carrying them, and its policies will be influenced by those who command its commerce. If we lose the seamen and artists whom it now employs, we lose the present means of marine defense, and time will be requisite to raise up others when disgrace and losses shall bring home to our feelings the disgrace of having abandoned them."

With 91 per cent. of our imports and exports now being carried in foreign vessels the marine resources of the United States have reached the dangerous condition of weakness so accurately described by Thomas Jefferson, wherefore the need for prompt and effectual remedial legislation was never greater than now.

8. As we have stated, the desperate condition of our ocean-going shipping has called forth at the hands of the president expressions of deep concern. Nor should the fact be overlooked that our shipping industry stands alone among all of our other



The Largest Vessel in the World. The White Star Liner Baltic on the Stocks at the Yard of Harland & Wolff, Belfast, Ireland.

great national industries in its shrinkage and decadence. Your committee, therefore, is impressed with the magnitude of the subject, the necessity for the most thorough care in its investigations, in order that our final conclusions may be such as to receive the approval of the members of the Maritime Association of the Port of New York. Reporting progress, therefore, in the prosecution of the work to which you have assigned us we request an extension of time for the final filing of our report.

LIVERPOOL SHIPPING LETTER.

Liverpool, Dec. 7.—The keen competition which now exists in the North Atlantic trade consequent upon the break up of the conference agreement has brought into being many rumors that, if not exactly groundless, are to say the least very much exaggerated. At the time of writing a report has become current that an amalgamation is pending between the White Star Line and the Hamburg-American Mediterranean services to Boston and New York, but the version vouchsafed by the White Star Line officials does not go quite so far. As a matter of fact no amalgamation of the two services has been arrived at or even contemplated, but only a working agreement, which has become quite a common feature of present-day shipping. Under this working agreement each of the before-mentioned companies will provide four steamers for the services between the Mediterranean and United States ports, the steamers of the Hamburg-American Line retaining New York as their terminal port, while the vessels of the White Star Line will run to Boston as already arranged. What perhaps has led to the amalgamation rumors is the fact that the Genoa branch office of the Hamburg-American company will also take over the management of this section of the White Star Line's business. The keen fight now taking place between these companies and the Cunard Line is becoming more and more interesting, and the splendid organization of each is being exercised to the full extent to attract European emigrants to the vessels of the respective lines. But notwithstanding the opposition, the Cunard company seems to be fairly successful in its self imposed task of ploughing the lonely furrow. In this connection I may also add that another statement which is in circulation here, and which may have been transmitted to the United States, to the effect that the order for the two leviathans for the Cunard company has been withdrawn or indefinitely postponed is also incorrect. On the other hand I have the best authority for stating that the orders for these new 25-knot transatlantic mail steamers will be shortly given out.

The ship building trade at Belfast is passing through a period of depression just now due to a combination of circumstances. With the launch of the new White Star vessel *Baltic* of nearly 24,000 tons register on Nov. 21, I gather that the famous Belfast yard of Messrs. Harland & Wolff has no further tonnage under construction for this line, a fact which has been unknown for many years past. Then the launch of the *Kenilworth Castle* today a huge vessel for the Union-Castle Line, will displace a large number of hands in the construction department, which is none too busily occupied just now. Further, I gather that work on two large vessels has been stopped, owing, it is said to a dispute between builders and owners, and 2,000 men are idle in consequence. Among the men employed at this particular yard the opinion prevails that the working arrangement with the International Mercantile Marine Co. has not had the good effect upon the Belfast ship building industry, which the public were led to believe would follow. But then, it was not anticipated that the shipping depression would be so protracted, or that freights would continue so unprofitable. The silver lining to this cloud of shipping adversity is still invisible, and to continue the building of new tonnage would only aggravate the situation. The present slackness at Belfast is rather the natural outcome of existing unprofitable tonnage than attributable to the policy of the Morgan combination. Belfast must bide its time with other ship building centers in this country.

Messrs. Benjamin Ackerley & Son of this port notify me that the New York & Porto Rico Steamship Co. has authorized them to resume shipments to ports in Porto Rico, the restrictions recently imposed by the United States treasury department having been removed. Goods will again be admitted in bond for transmission as formerly.

The Paris international conference of sailing ship owners, which is to be held this week, is attracting no little attention here among that section of shipping directly affected. It is however conceded by Mr. R. W. Leyland, who speaks on behalf of his colleagues at this port, that at present there appears to be great difficulty in attempting to remedy the prevailing unsatisfactory state of things, owing to the absence of unanimity among British ship owners on the subject, but he is of opinion that sooner or later British ship owners will be compelled to stand together in order to protect themselves, and prevent the mercantile trade of the country from being practically destroyed. Mr. Leyland's suggestions for a remedy to meet the depression at present prevailing in the sailing ship business are briefly as follows: (1) To arrange a minimum rate of freight for all the principal sailing ship voyages. (2) Until such minimum freight be obtainable, vessels to lie up or to have the option of proceeding in ballast to any port where the arranged minimum rate of freight may be obtained. (3) A central committee or committees, advisory council or councils, to be appointed in either London or Paris or both cities, for the purpose of considering matters incidental to the above propositions as they arise, and if necessary to amend minimum rates of freight suggested. These propositions will doubtless be

considered by the conference, but whether they will be acceptable to the delegates of other countries remains to be seen. As a purely British remedy against bounty-aided foreign competition, Mr. Leyland advocates a charge being imposed on the incoming vessels of countries which granted subsidies, or on the cargo of such.

MARINE CONSTRUCTION & D. D. CO.—WORK IN HAND.

A change in administration officers has lately been made in the Marine Construction & Dry Dock Co. of Mariner Harbor, Staten Island, New York. The officers now are: Ralph Derr, president; Harold Lee, treasurer; F. S. Brinton, secretary and constructor, and John E. Consalus, general manager. The company has two marine railways, one of 100 and the other of 500 tons capacity, and a spacious storage basin, in which are at present stored many yachts and launches. As this basin is located at the meeting of the tide flowing through the Kill Von Kull and Arthur Kill, around Staten island, it makes an ideal storage place for vessels.

In the yards the company has under construction a steam, twin-screw steel house-boat, a steel tug, a tow and cargo boat for parties in Santiago, Cuba, and fifteen life-boats for the United States government, a very fair showing for a new yard at the present time, and all the more so as it has been the rule of the company to take contracts at a fair price, letting others do cheap work at cheap prices.

The steel house-boat is being built for Mr. Isaac E. Emerson of Baltimore, after designs by Sadler, Perkins & Field, naval architects, Maritime building, New York, and Detroit, Mich. She is 116 ft. in length, 21 ft. beam and 3 ft. draught, with height between decks of 7 ft. 6 in. She is of torpedo boat type. The hull—now completed—is constructed of steel to the height of the upper fender, 7 ft., and has a Thorneycroft type tunnel stern and scow bottom. Her lines are extremely graceful, making her a thing of beauty in keeping with the intentions of her owner, designers and builders to make her the finest house-boat in the world.

Her motive power will consist of two Almy water-tube boilers and two sets of Murray & Tregurtha vertical-inverted triple-expansion engines, cylinders 5, 10 and 15 with 10 in. stroke, of 125 H. P. each. Auxiliaries will be surface condenser and feed-water heater, Blake pumps, a 5-kilowatt General Electric dynamo, which will electrically light the boat throughout, including a search light, and an Allen dense-air ice machine of one ton capacity, furnished by H. B. Roelker, 41 Maiden lane, N. Y., who has furnished refrigerating apparatus for many fine yachts as well as for large steamers and naval vessels, over a hundred of them of varying capacity being at present in daily use on vessels.

The internal arrangements of the boat have evidently been the subject of considerable study by the designers, which has resulted in a subdivision of interior into saloon, staterooms, engine room, crew's quarters, etc., of the greatest possible convenience, while being spacious. Immediately abaft of the collision bulkhead will be the owner's bath room, 6 ft. deep by full width of the boat, next to which comes the owner's stateroom, full width of boat by 10 ft. From this room, through the center of the boat, a passageway leads aft to the main vestibule; on either side of this passageway are two guests' staterooms, four in all, each about 9 by 10 ft., which are furnished with independent toilet rooms. From the main vestibule a companionway leads forward to the deck house above, while on the port side will be another bath room. In this vestibule will be gun racks, ammunition lockers and receptacles for other sporting paraphernalia. Adjoining the vestibule aft comes the coal bunkers—made ample by extending them from bottom of the hold to the upper deck—and the engine and boiler space which is amidships, around which on starboard side, a passageway leads to the main saloon, which will be 14 ft. 6 in. by full width of boat. This saloon will be fitted with two sideboards, glass and silver lockers, bookcases, lounging seats, cozy corners and an open fire place. From this room the main companionway will lead to the upper deck. Aft of the saloon come pantry and galley, each 6 by 9 ft., aft of which will be the crew's mess room and quarters for officers and crew, staterooms being provided for the officers, from captain down, which will be provided with toilet rooms. These staterooms will open onto passageway leading from mess room to main deck aft.

On the upper deck will be a large deck house with a flying bridge on its roof. The deck house will be handsomely finished in white walnut and contain, besides seats and hangings, a piano, desk and bookcase. There will be a railing all about the upper deck with awnings fore and aft. Aft of the deck house will be a shelter seat—a provision for stormy weather—while forward an observation seat will be provided. On the flying bridge will be located the wheel house, which will be connected with the engine room and other parts of the vessel by the most modern telegraph signal, telephone, call bells, etc.

All apartments on the main deck will be finished in white enamel and mahogany, all bath rooms tiled, and the vessel heated throughout by steam. In fact she is to be up to date in every particular, with a guaranteed speed of 10 miles an hour.

The J. L. Mott Iron Works of New York, furnishes the plumbing, bath and toilet appurtenances and J. W. Benson of Baltimore does the upholstering. An advanced feature for such craft is the adoption by the owner of the New York Belting & Packing Co.'s interlocking rubber tiling for all passageways and decks, which was decided upon after a thorough investigation as to its value for such purpose. This tiling, as all persons posted in

the matter are aware, is now being used to great advantage as floor and deck covering on steamships, ferry boats and yachts. It is also largely used for floor covering for corridors in hotels, office and public buildings, offices, court rooms, etc.

The steel tug for towing and passenger service in Costa Rica is 60 ft. in length, 12 ft. beam and 4 ft. draught. She will have Scotch boiler and a Wells patent balanced compound engine, with cylinders 7 and 14 in. by 10 in. stroke, of 125 H. P. All space forward of boiler and engine room will be used for cargo, while aft will be mail and toilet rooms. A wood awning will cover the upper deck fore and aft, while side seats will be provided for passengers.

The tow, cargo and passenger boat building for Santiago parties is to be used in Cuba for towing Mahogany log rafts and carrying freight and passengers. She is built of wood, copper bottomed, is 75 ft. in length, 16 ft. beam and 5 ft. 3 in. draught. Her propelling power will be a 75 H. P. Standard gasoline engine, built by the United States Long Distance Automobile Co. of Jersey City, N. J., an engine, by the way, that is gaining an enviable reputation as motive power for both boats and automobiles, as it combines lightness, power, speed and endurance, very necessary qualities in an up-to-date gasoline engine. All space forward of the engine room will be for freight, for the handling of which a crane of one ton capacity is provided, freight being stored in the hold through a large hatch. The hoisting gear operating the crane is in direct communication with the engine shaft and can be thrown into service at will by movement of a lever in the pilot house which connects a friction clutch on the main shaft with the hoisting apparatus. The pilot house and toilet rooms are located amidships, while a covered deck aft furnishes accommodations for passengers. Her speed is to be from 11 to 12 miles an hour.

The fifteen double-skin mahogany life boats, which the company is building for the United States government, are to be used in the life-saving service. They are of the non-sinkable, self bailing variety, costing \$1,000 each, are rapidly nearing completion and will soon be ready for delivery. In fact all the work mentioned is in an advanced condition, with other work offering, as the reputation of the company for turning out superior work is becoming known.

GEO. W. RAMAGE.

COMMISSION TO INVESTIGATE SHIPPING.

Representative Gardner of Massachusetts introduced a bill in the house a few days ago creating a commission to consider and recommend legislation for the development of an American merchant marine, in accordance with the suggestions contained in the president's message. The bill provides that the commission is to be composed of the secretary of the navy, postmaster-general, the secretary of commerce and labor, and three members each of the senate and house. The commission is to investigate and report to congress at the next session what legislation

is desirable for the development of the American merchant marine, commerce, and incidentally for a national ocean mail service of adequate auxiliary naval cruisers. The investigation is to be conducted by hearings.

INVESTIGATING WRECKS CAUSED BY OVERLOADING.

Senator Perkins of California offered the following resolution in the United States senate last week which was adopted after minor discussion between him and Senator Spooner:

"Whereas disasters to documented vessels on the Atlantic and Pacific coasts number each year nearly 500; and whereas the values of said vessels and their cargoes aggregate not far from \$10,000,000; and whereas said disasters imperil the lives of 3,000 or more persons; and whereas it is alleged that many of these disasters are due to overloading or improper loading of cargo; therefore, be it

Resolved by the senate, that the secretary of commerce and labor be, and he is hereby, directed to transmit to the senate a statement showing the losses at sea reported by collectors of customs during the last fiscal year of American merchant vessels, sail and steam, over 100 tons gross registry, in so far as there may be reason to believe that said losses were caused by overloading or improper loading of cargo."

Rear Admiral Bancroft Gherardi died at his home at Stratford, Conn., last week where he had lived since his retirement from the navy in 1894. He was nephew of the historian George Bancroft, whose name he bore. He was born at Jackson, La., Nov. 10, 1832, and was appointed midshipman in the navy from Massachusetts in 1846.

The National Pilots' association held its biennial convention at Washington recently. Representatives from all ports of the United States were present. Capt. J. Edward O'Brien of Pensacola, Fla., was elected president; Capt. Edward Young of New York, vice-president; Capt. J. H. Low of Boston, secretary and treasurer.

M. B. McDonald & Sons, Mystic, Conn., have taken an order for a four-masted wooden schooner from Miller, Houghton & Co., ship brokers of New York. The new schooner will be 160 ft. long, 37 ft. beam and 13 ft. deep.

The Rice Bros. Co. has been organized at East Boothbay, Me., to succeed the firm of Rice Bros., ship builders, with \$100,000 capital stock, of which \$75,000 has been paid in.

Senator Frye offered a bill in the senate this week to appropriate \$175,000 for a vessel to remove or destroy derelicts.

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French Navy	-	-	-	-	-	-	-	-	355,560 H. P.
English Royal Navy	-	-	-	-	-	-	-	-	929,300 "
Russian Imperial Navy	-	-	-	-	-	-	-	-	227,500 "
Japanese Imperial Navy	-	-	-	-	-	-	-	-	122,700 "
Austrian Imperial Navy	-	-	-	-	-	-	-	-	56,700 "
Italian Royal Navy	-	-	-	-	-	-	-	-	13,500 "
Chilian Navy	-	-	-	-	-	-	-	-	26,500 "
Argentine Navy	-	-	-	-	-	-	-	-	13,000 "
The "Messageries Maritimes" Company	-	-	-	-	-	-	-	-	87,600 "
Chemins de fer de l'Ouest: (The French Western Railway Co.)	-	-	-	-	-	-	-	-	Steamships
plying between Dieppe and Newhaven	-	-	-	-	-	-	-	-	18,500 "
Total Horse Power of Boilers in Use	-	-	-	-	-	-	-	-	1,850,860

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TRADE NOTES.

The H. Mooers Co., Milwaukee, has of late built up quite a substantial marine trade. They are dealers in pipe valves and fittings and marine engineers' supplies. They carry a full stock of goods of the best manufacture and have a well-equipped machine shop and steam fitting shop with a competent force of mechanics to attend to all calls.

Mr. C. O. Bartlett of the C. O. Bartlett & Snow Co., Cleveland, manufacturers of mill and labor-saving machinery, says of the business outlook: "Of course there has been a dropping off generally in the demand for machinery, but our orders are keeping up well, especially for our labor-saving specialties. We still believe that the coming year will be a prosperous one for all substantial manufacturing concerns. The weak ones will suffer and it will be harder to make sales than during the past couple of years, but the manufacturers as a class have been preparing for close margins and that is a strong feature of the situation."

A new line of air compressors is described in bulletin L-509, recently issued by the Laidlaw-Dunn-Gordon Co., 114 Liberty street, New York city. These compressors are fitted with Meyer steam-valve gears, permitting of an adjustable cut-off. The air ends are arranged both with poppet inlet and outlet valves and with mechanically-operated inlet and poppet outlet valves, the valves in either case being placed in the head of the cylinder, permitting the body to be effectively water-jacketed. The frames of the compressors are specially heavy. The capacities listed range from 468 to 2,220 cu. ft. of free air per minute, and the air pressures from 80 to 100 lbs. per sq. inch. This pamphlet will be sent upon request to those interested.

In no branch of government service has the matter of ventilation been given such serious consideration as in the navy. The construction of the modern vessel renders it extremely difficult to secure proper ventilation in some portions below the water line. Noticeable for its novelty, among the various methods used to properly ventilate such places is the portable ventilating set,

consisting of a small exhauster of the monogram type directly connected to an enclosed electric motor. It is very light, moves a large body of air, and is provided with handles for carrying from place to place, enabling the crew to work in any portion of the vessel with comfort, and is but one of the many types of blowers manufactured by the B. F. Sturtevant Co., Boston.

The Hills-McCanna Co. of 128 E. Kinzie street, Chicago, manufacturers of steam specialties, has found a large sale of late among engineers of lake vessels for a type of pump that is used for introducing graphite into engine cylinders. One of the officials of the Joseph Dixon Crucible Co. says on this score: "We have always advocated the use of a small hand oil pump for introducing graphite into the engine cylinders by way of the steam pipe. The pump is attached to the steam pipe, a mixture of graphite and oil is made, using 10 to 15 per cent. if necessary, but preferably 3 to 5 per cent., of finely-pulverized graphite. The mixture is made of about the consistency of molasses, and is pumped in occasionally. The experienced engineer is always able to tell about when the engine needs a dose of it. As an example, we have an 80 H. P. engine, which runs our rubber and brass factory. Monday is our grinding day, and before we attached the pump to our engine for the introduction of graphite, simply depending upon the sight feed lubricator, the engine would stall when the heavy rubber rolls were thrown on. After the graphite oil pump was attached and the graphite well introduced into the cylinder, and the bearing also touched up with a little graphite, the friction of the engine was sufficiently reduced to prevent it from stalling. At the present time we are using on this engine the Hills-McCanna pump. We have had it on for about a year and it has been thoroughly successful. With this pump feeding a mixture of graphite and oil—about 3 per cent. graphite—there has been no need for the use of either the old-time oil pump or the sight feed lubricator. The Hills-McCanna, as we have already said, has been in use for about a year or a little over a year, and with the exception that its main bearings are somewhat worn and the pump also somewhat worn, the machine is as good as when it was first attached. We may add that we believe the time will come when force-feed lubrication will be very much more in evidence than it is at the present time, and that a small percentage of graphite will be invariably used for engine lubrication as well as for general lubrication." The Joseph Dixon company publishes two very interesting pamphlets, "Graphite as a Lubricant" and "Graphite for Cylinders and Valves," that may be had for the asking.

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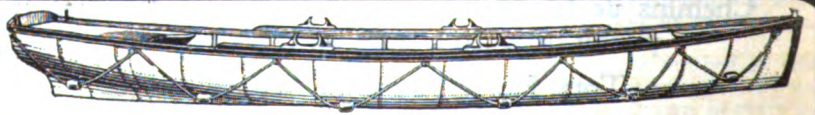
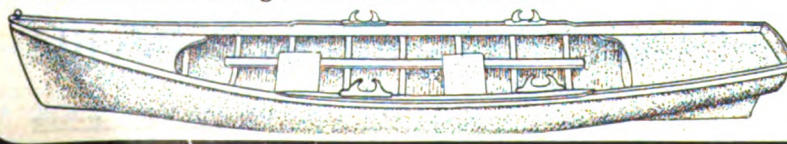
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Manufacturers of Metal Boats and Skiffs.

NEW BRITISH ADMIRALTY CHARTS.

2167. Scotland, north coast:—Firth of Cromarty.
 1596. Harbors and anchorages on the coast of Italy:—Salerno bay. Port Salerno. Port Torre del Greco. Port of Naples.
 1687. Sicily:—Messina harbor.
 3351. Greece, south coast:—Port Skutari.
 3379. Mexico, south-west coast:—Pichilique harbor.
 3380. Persian gulf:—Bahrein harbor.
 3349. China sea:—Approach to Kwang chau wan.
 3280. China, east coast:—Hongkong waters, west.
 3294. China. Yang tse Kiang. Hupeh province:—Hankau.
 3378. China, north coast:—Rocky point to Temple head.
 3352. Tasmania, west coast. Port Davey:—Bramble and Schooner coves.
 3322. South America, north-east coast. Orinoco river. Plan added:—Cano Imataca (Rio Corosimo).

CHARTS THAT HAVE RECEIVED ADDITIONS OR CORRECTIONS.

2793. England, south coast:—Cowles harbor.
 2076. Scotland, north coast:—Loch Eriboll.
 3158. Norway:—Nevlunghavn to Torbiørnskie.
 3159. Norway:—Torbiørnskie to Jæloen.
 3160. Norway:—Torbiørnskie to Rauo.
 2298. Baltic sea. Gulf of Bothnia:—Nystad light to Storfiard.
 2299. Baltic sea. Gulf of Bothnia:—Hornslandet to Stierno point.
 2368. Germany, north coast:—Jershoft light to Rixhoft light.
 201. Adriatic sea:—The coasts of the gulfs of Venice and Trieste.
 1986. Gulf and river St. Lawrence:—Buctouche river.
 2892. East coast of United States:—Narragansett bay.
 1325. Chile. Gulf of Penas to the Guaytecas islands.
 2248. Mexico, south-west coast:—Anchorages in the gulf of California.
 2840. British Columbia:—Haro Strait and Middle channel.
 584. British Columbia:—Clayoquot and Barkley sounds.
 20. Persian gulf:—Bahrein harbor.

1750. Australia, south coast:—Port Adelaide.
 1070. Australia, east coast:—Port Stephens.
 214. Solomon islands.
 J. D. Potter, 145 Minories, London, E., is admiralty agent for the sale of charts.

STAGES OF WATER.

Gage records of the United States lake survey show the following mean stages of water above mean sea level for November, 1903:

	Stages during Nov.	Higher than during same month last year.	Lower than during Nov. 1895.	Higher than during Nov. 1895.
	ft.	ft.	ft.	ft.
Lake Superior	602.62	0.09		0.33
Lake Michigan	579.83	0.07		1.13
Lake Huron	579.89	0.21		1.07
Lake Erie	571.86		0.25	1.07

The present fall, Lake Huron to Lake Erie, is 0.46 ft. more than a year ago.

A fine catalogue has just been issued by the David Bell Engineering Works, Buffalo, devoted to their steam hammers. The Bell steam hammer is the result of many years careful attention and study. The regular Bell hammer in four sizes is built without overhanging guides, and it is stated that there is no other hammer on the market which permits of such a wide range of work. The construction of the falling parts is such as to secure effective guiding and rigidity of blow, and for ordinary blacksmith work they are a superior tool. The standard guide hammer is designed to do all kinds of forging work and built accordingly, being especially valuable in working steel into shape. All the sizes are from comparatively new patterns, with every improvement, and reference to the cuts, of which there are ten reproduced from photographs in the catalogue, will show the broad and liberal lines upon which they are designed. The catalogue is a work of art and will be mailed to anyone who is interested in the subject.

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For Sale.—Two dredging plants complete, consisting of two dredges, tugs Maytham and Duncan Robertson; also five dump scows and two flats, with sundry duplicate parts of machinery, etc.; also extra spud anchors and dipper teeth, etc.; all having been kept up in good working condition and comparatively new, and could be delivered at once on satisfactory sale. For further information as to capacity and prices of each plant inquire of James Pryor, Houghton, Mich. Dec. 17

For Sale—A Bargain.

One Brown Hoisting Machinery Company all iron and steel post jib crane, 15-ton capacity, 35 ft. 3 in. radius of hook, 18 ft. 6 in. lift. The hoisting mechanism is driven by dust-proof motor. The crane is in excellent condition and has been a very satisfactory machine. A. Garrison Foundry Co., Pittsburgh, Pa. Dec 10

Yacht for Sale.

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Wanted fore-and-aft compound engine of 14 and 28 in., or a little smaller would do. Address Capt. F. Dana, Alexandria Bay, N. Y. Dec. 31

Hull Draughtsman Wanted.

Hull draughtsman experienced in battleship work wanted by the Fore River Ship & Engine Co., Quincy, Mass. Apply at once. Dec. 24

Treasury Department, U. S. Life-Saving Service, Washington, D. C., December 8, 1903. Sealed proposals will be received at this office until 2 o'clock, p. m., of Wednesday December 30, 1903, and then publicly opened, for the construction of one 34-foot self-righting and self-bailing life-boat with gasoline engines, centerboard, and sails. Specifications and drawings, forms of proposals, etc., can be obtained upon application to the Inspector of Life-Saving Stations, 17 State Street, New York City; the Assistant Inspector, 1st & 2d Life-Saving Districts, Room 148 Postoffice Building, Boston, Mass.; the Assistant Inspector, 10th & 11th Life-Saving Districts, Room 204 Postoffice Building, Detroit, Michigan; or to this office. Specifications and complete detailed working drawings of the gasoline engines which the bidders propose to install in the boat must be submitted with proposals. S. I. KIMBALL, General Superintendent. Dec. 17



Proposals for the Improvement of the Port of Iloilo, P. I.—Sealed proposals in triplicate will be received until noon, February 1, 1904, and thereafter publicly opened for the following work to be done at Iloilo, P. I., or as much thereof as may be completed for the sum of \$150,000 U. S. currency. The construction of 6,100 lineal feet of dike or fascine bank protection composed of piles, mattresses and stone. The dredging of 410,000 cubic yards of material in the river channel and the depositing of the material back of the dikes. Envelopes containing proposals should be plainly marked "Proposals for the Improvement of the Port of Iloilo, P. I." Plans, specifications and contracts can be obtained and examined at this office or at the U. S. Engineer's offices at New York, Chicago, San Francisco and Portland, Oregon; also at the Bureau of Insular Affairs, Washington, D. C. Bidders are invited to be present at 4 p. m., February 1, 1904, when bids for the work as a whole will be opened. Address all communications to the Consulting Engineer to the Commission, Santa Potenciana Building, Manila, P. I. J. W. BEARDSLEY, Consulting Engineer to the Commission. Dec. 24

Proposals for the Improvement of the Port of Cebu, P. I.—Sealed proposals in triplicate will be received until noon, February 1, 1904, and thereafter publicly opened for the following work to be done at Cebu, P. I. The construction of a bulkhead and dock about 2,600 feet long, the dredging of the channel adjacent to said bulkhead, and the filling in of the area immediately back of the same, or so much thereof as may be completed for the sum of \$350,000 U. S. currency. Envelope containing proposal should be plainly marked "Proposal for the Improvement of the Port of Cebu." Plans and specifications can be obtained and examined at this office or at the U. S. Engineer's offices at New York, Chicago, San Francisco and Portland, Oregon; also at the Bureau of Insular Affairs, Washington, D. C. Bidders are invited to be present at 4 p. m., February 1, 1904, when bids for the work as a whole will be opened. Address all communications to the Consulting Engineer to the Commission, Santa Potenciana Building, Manila, P. I. J. W. BEARDSLEY, Consulting Engineer to the Commission. Dec. 24

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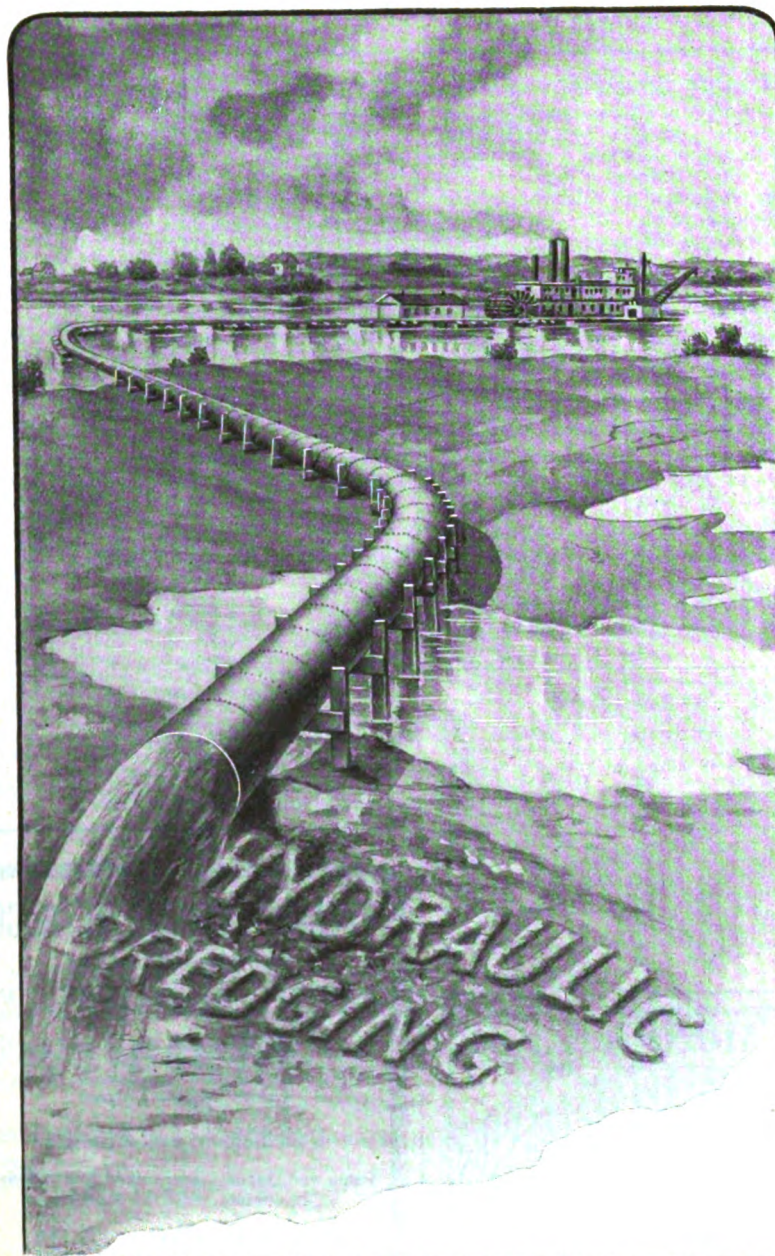
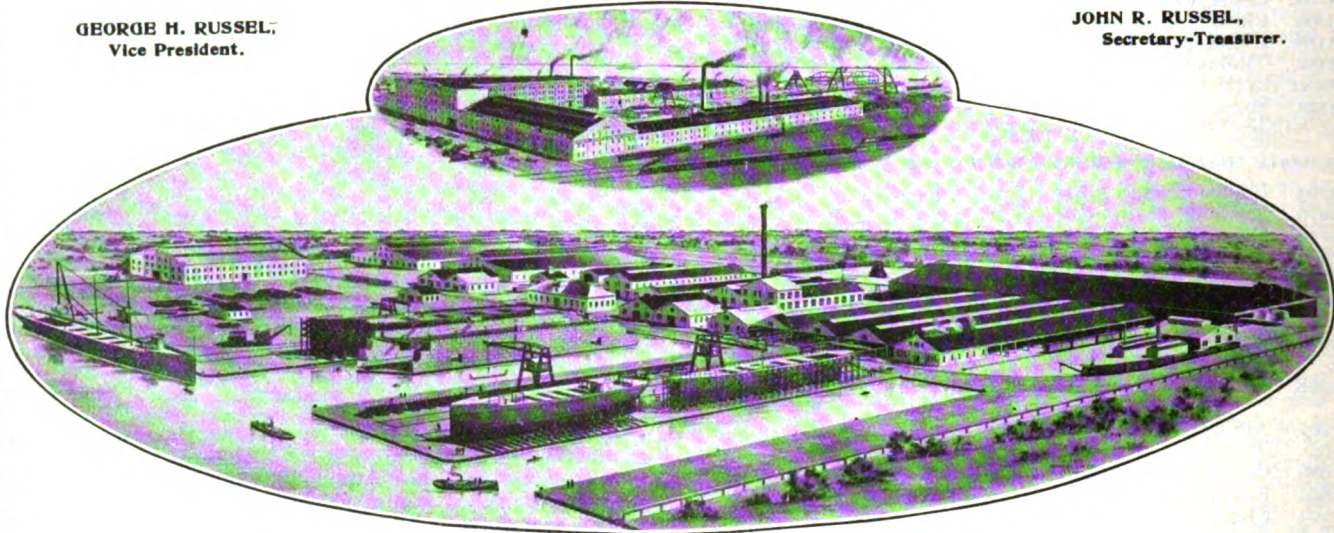
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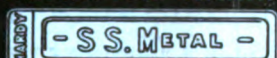
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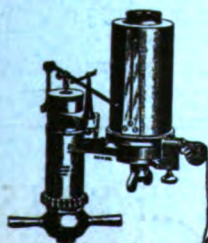
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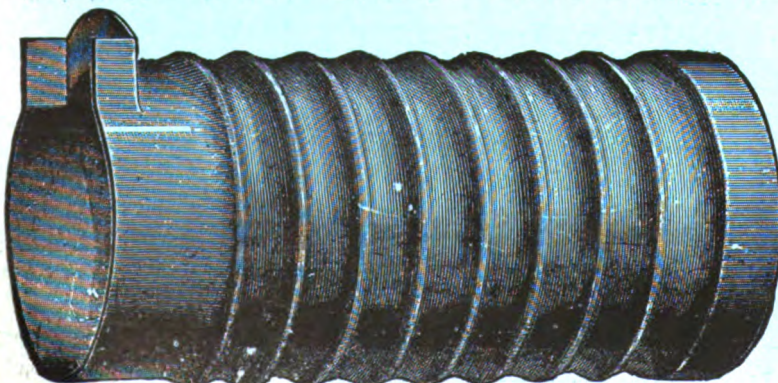
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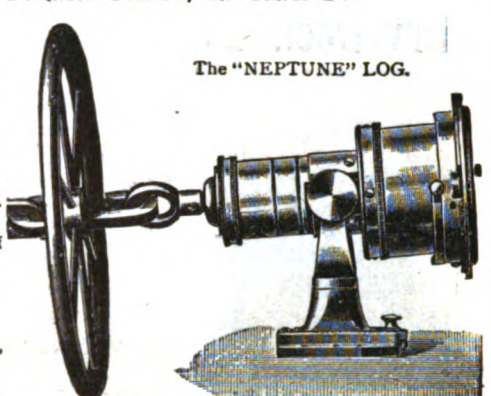
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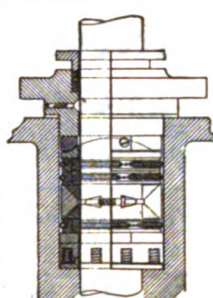


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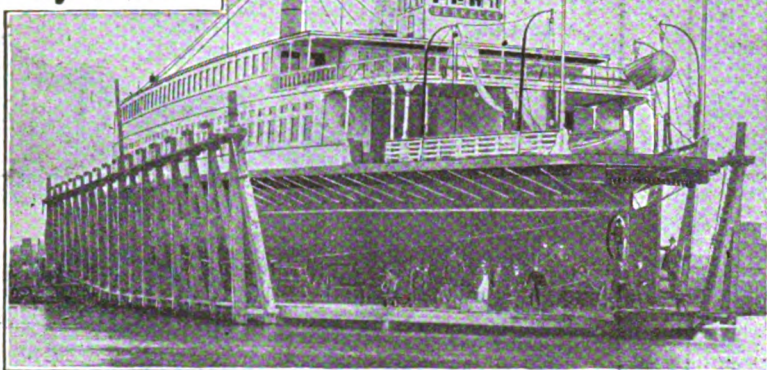


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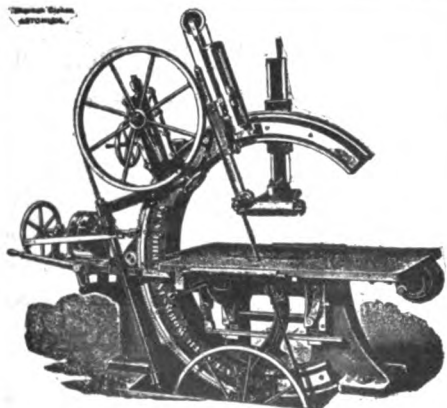
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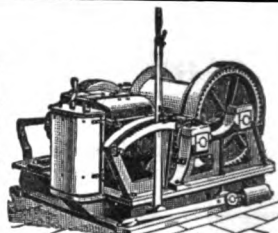
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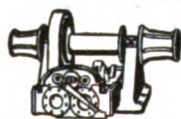
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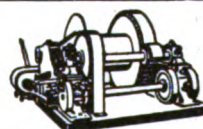
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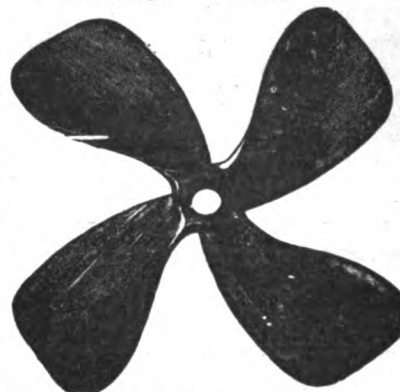
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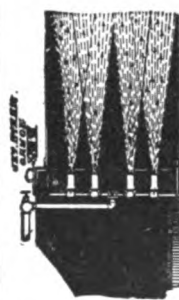
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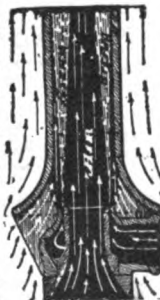
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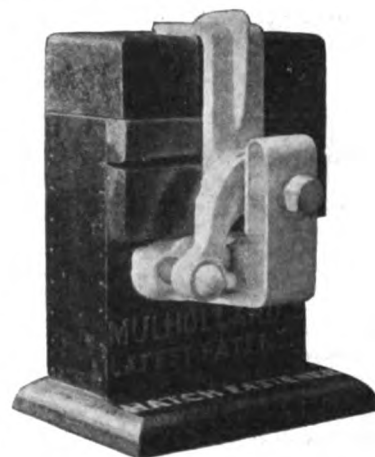


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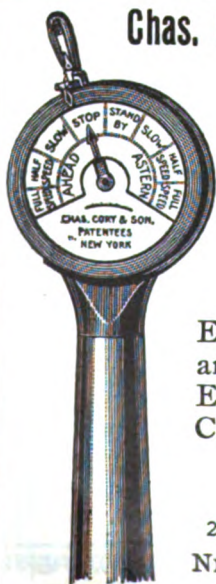
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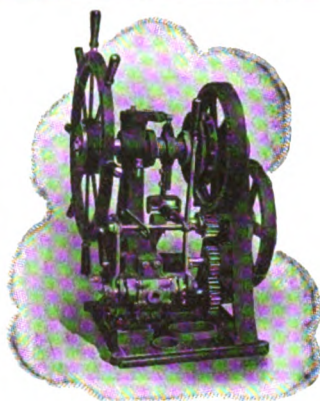
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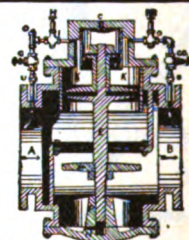
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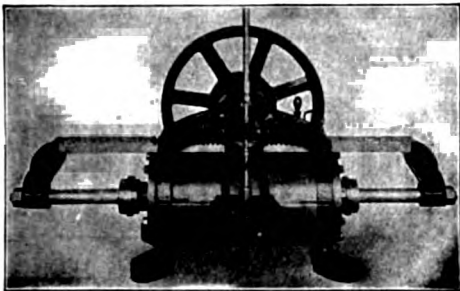
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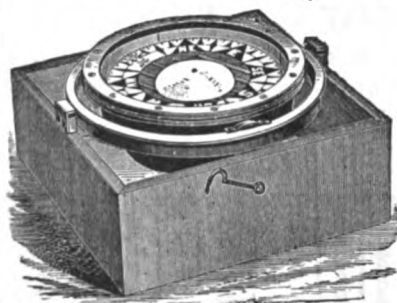
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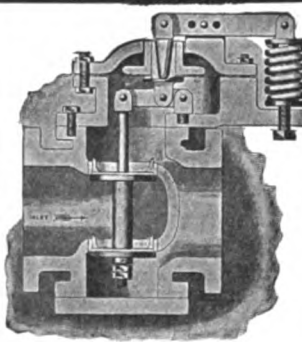
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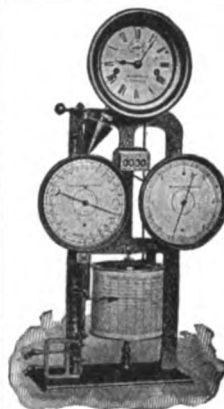
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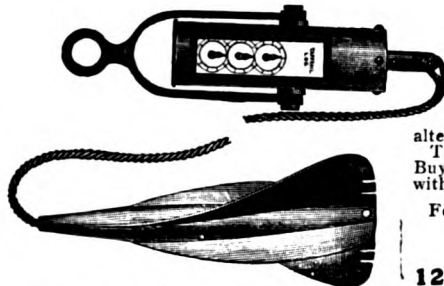
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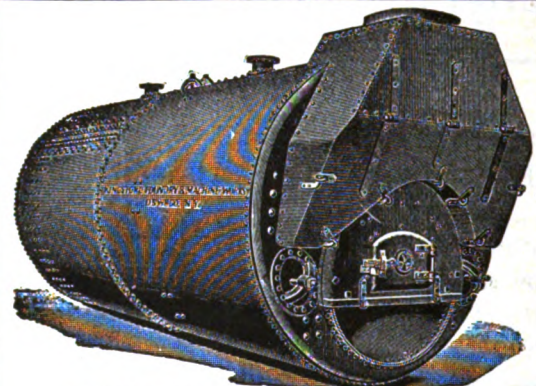
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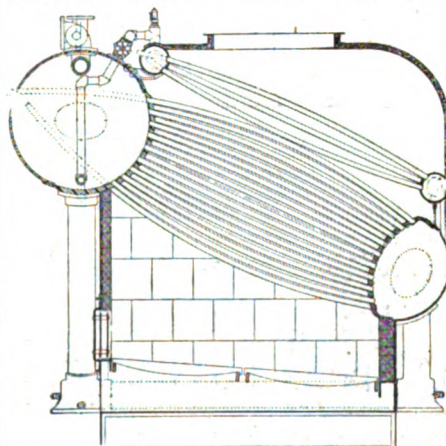
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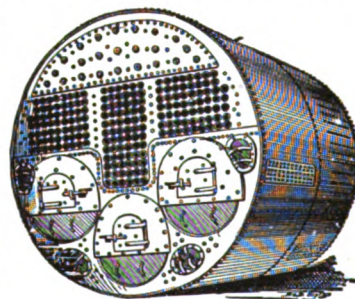
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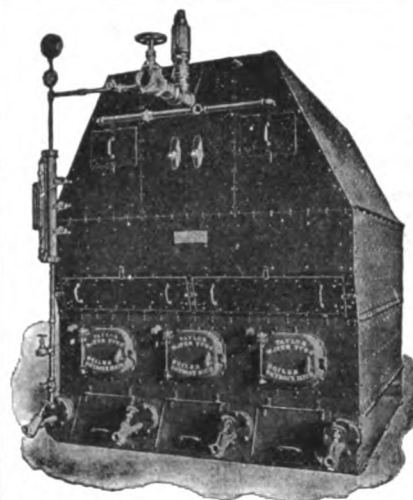
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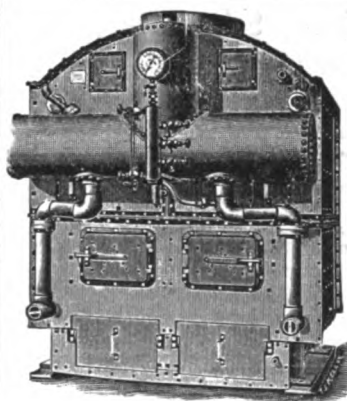
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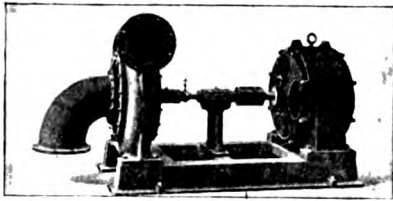
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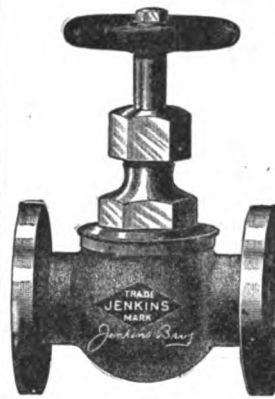
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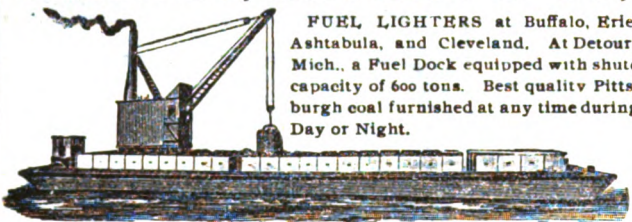
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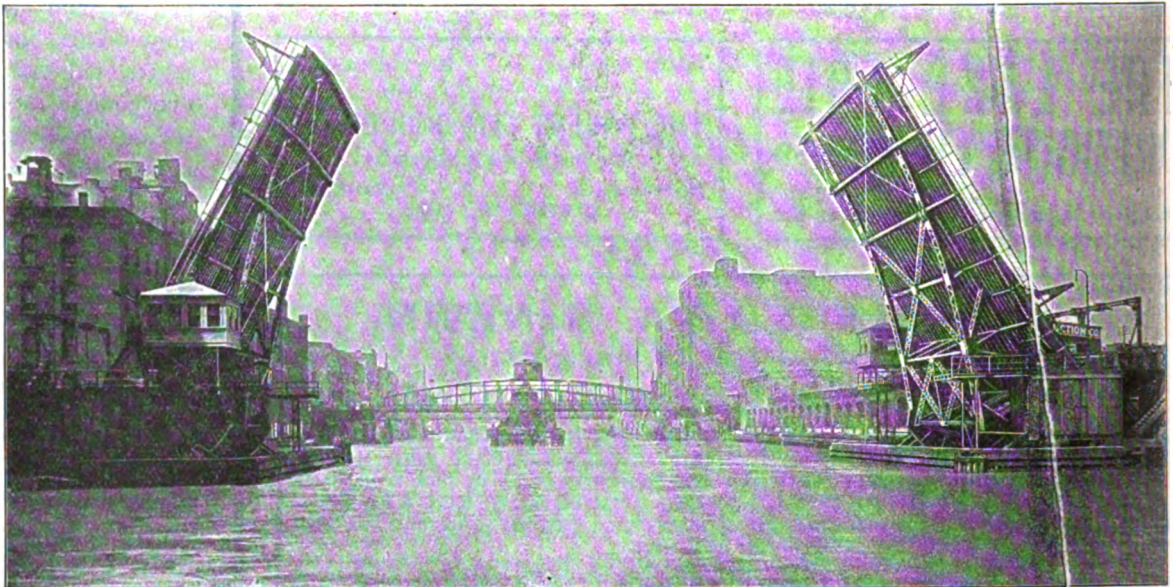
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Warrington Iron Works.....Chicago.
Willard, Chas. P. & Co.....Chicago.

BOILER MANUFACTURERS.

Almy Water Tube Boiler Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Babcock & Wilcox Co.....New York.
Boyer's Sons, L.....New York.
Chicago Ship Building Co.....Chicago.
Cramp, Wm. & Sons.....Philadelphia.
Delaney Belleville & Co.....St. Denis, France.
Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Forest City Boiler Co.....Cleveland.
Great Lakes Engineering Works.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Kingsford Foundry & Machine Works Oswego, N. Y.
Maryland Steel Co.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher Water-Tube Boiler Co.....New York.
Newport News Ship Building Co Newport News, Va.
Northwestern Steam Boiler & Mfg. Co., Duluth, Minn.
Ridson Iron Works.....San Francisco.
Roberts Safety Water Tube Boiler Co.....New York.
Stirling, The Co.....Chicago.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co.....Detroit.
Union Machine & Boiler Co.....Cleveland.
United States Ship Building Co.....New York.
Warrington Iron Works.....Chicago.
Willard, Chas. P. & Co.....Chicago.

BOILER COMPOUNDS.

Dearborn Drug & Chemical Works.....Chicago.

BOILER RIVETS.

Bourne-Fuller Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.

Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BOOKS, NAUTICAL AND ENGINEERING.

Audel & Co., Theo.....New York.
Marine Review Pub. Co.....Cleveland.

BRASS AND BRONZE CASTINGS.

Cramp, Wm. & Sons.....Philadelphia.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Lunkenheimer Co.....Cincinnati.
Macbeth Iron Co.....Cleveland.
Phosphor Bronze Smelting Co.....Philadelphia.

BRIDGES, BUILDERS OF

Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.

Bartlett & Snow Co., C. O.....Cleveland.
Brown Hoisting & Conveying Machine Co. Cleveland.
Wellman-Seaver-Morgan Co.....Cleveland.

CABIN AND CABINET FINISHING WOODS.

Martin-Barriss Co.....Cleveland.

CAPSTANS.

American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

CARPETS, FURNITURE, BEDS, ETC.

Siegel Cooper Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.

Smoot-On Mfg. Co.....Jersey City, N. J.

CHAINS.

Standard Chain Co.....Pittsburg.

CHAIN HOISTS.

Boston & Lockport Block Co.....Boston, Mass.
Dake Engine Co.....Grand Haven, Mich.

CHARTS.

Marine Review Pub. Co.....Cleveland.
Potter, J. D.....London.

CIRCULATOR, EQUILIBRIUM.

With Steam Heating Attachment.

Bloomsburg & Co., H.....Baltimore, Md.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.

Ashton Valve Co.....Boston.
Bliss, John & Co.....New York.
Crelsea Clock Co.....Boston.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.

Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburg Coal & Iron Co.....Buffalo.

COAL AND ORE HANDLING MACHINERY.

Bartlett & Snow Co., C. O.....Cleveland.
Brown Hoisting Machinery Co., (Inc.).....Cleveland.
Lidgerwood Mfg. Co.....New York.
Wellman-Seaver-Morgan Co.....Cleveland.

COMPASSES.

Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

COMPASS ADJUSTER.

Smith, Capt. W. J.....Seattle, Wash.
McNevin, Alfred D'A.....Detroit.

CONDENSERS.

Thropp & Sons Co., John E.....Trenton, N. J.

CONTRACTORS FOR PUBLIC WORKS.

Buffalo Dredging Co.....Buffalo.
Chicago & Gt. Lakes Dredge & Dock Co.....Chicago.
Fitz-Simons & Connell Co.....Chicago.
Lake Erie Dredging Co.....Buffalo.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H.....Milwaukee.

COPPER, TIN AND SHEET IRON WORK.

McCutcheon, C. H.....Buffalo.
Ripley Hardware Co.....Grafton, Ill.

CORDAGE

Baker & Co., H. H.....Buffalo.
DeGrauw, Aymar & Co.....New York.
Upson-Walton Co.....Cleveland.

CORK JACKETS AND RINGS.

Armstrong Cork Co.....Pittsburg Pa.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Long Island City, N. Y.

CHAIN CONVEYORS, HOISTS.

Bartlett & Snow Co., C. O.....Cleveland.
Brown Hoisting Machinery Co., (Inc.).....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mfg. Co.....New York.
Westinghouse Electric & Mfg. Co.....Pittsburg, Pa.

DISTANCE FINDER.

Nicholson Ship Log Co.....Cleveland, O.

DIVING APPARATUS.

Morse, A. J. & Son.....Boston.
Schrader's Son, A.....New York.

DREDGING CONTRACTORS.

Buffalo Dredging Co.....Buffalo.
Chicago & Gt. Lakes Dredge & Dock Co.....Chicago.
Fitz-Simons & Connell Co.....Chicago.
Lake Erie Dredging Co.....Buffalo.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H.....Milwaukee.

DRYING APPARATUS.

Sturtevant, B. F. Co.....Boston.

DRY DOCKS.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.
Lockwood Mfg. Co.....East Boston, Mass.
Manitowoc Dry Dock Co.....Manitowoc, Wis.
Marine Construction & Dry Dock Co.....New York.
Maryland Steel Co.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co Newport News, Va.
Shipowners Dry Dock Co.....Chicago.
Superior Ship Building Co.....Superior, Wis.
United States Ship Building Co.....New York.

ELECTRIC HOISTS AND CRANES.

Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mfg. Co.....New York.
Westinghouse Electric & Mfg. Co.....Pittsburg, Pa.

ELECTRIC LIGHT AND POWER PLANTS.

Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Sturtevant, B. F. Co.....Boston.
Westinghouse Electric & Mfg. Co.....Pittsburg, Pa.

ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Dake Engine Co.....Grand Haven, Mich.
Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit, Mich.
Hall Bros.....Philadelphia.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mfg. Co.....East Boston, Mass.
Macbeth Iron Co.....Cleveland.
Maryland Steel Co.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher, Chas. D.....New York.
Moulton Steering Engine Co.....New York.
Newport News Ship Building Co Newport News, Va.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

ENGINE BUILDERS, MARINE.—Continued.

Northwestern Steam Boiler & Mfg. Co., Duluth, Minn.
 Alston Iron Works, San Francisco.
 Roach's Ship Yard, Chester, Pa.
 Sheriff's Mfg. Co., Milwaukee.
 Superior Ship Building Co., Superior, Wis.
 Thropp, J. E. & Sons Co., Trenton, N. J.
 Trout, H. G., Buffalo.
 United States Ship Building Co., New York.
 Warrington Iron Works, Chicago.
 Willard, Chas. P. & Co., Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.
 Cory, Chas. & Son, New York.
 MacLean Hydraulic Signal Co., Chicago.

ENGINEERING SPECIALTIES AND SUPPLIES.
 Crane Co., Chicago.
 Kieley & Mueller, New York.
 Lunkenheimer Co., Cincinnati.
 McCutcheon, C. H., Buffalo.
 Moners & Co., Milwaukee.
 New York Belting & Packing Co., New York.
 Northwestern Steam Boiler & Mfg. Co., Duluth, Minn.
 Reilly Repair & Supply Co., New York.
 Rippley Hardware Co., Grafton, Ill.

ENGINEERS, MARINE, MECHANICAL,
CONSULTING.

Hynd, Alexander, Cleveland.
 Hunt, Robt. W. & Co., Chicago.
 Kidd, Joseph, Duluth, Minn.
 Matteson & Drake, Philadelphia.
 Moffat & Son, San Francisco.
 Mosher, Chas. D., New York.
 Nacey, James, Cleveland.
 Newman, R. L., New York.
 Pittsburgh Testing Laboratory, Ltd., Pittsburgh.
 Powell, Ambrose V., Chicago.
 Roelker, H. B., New York.
 Sadler, Perkins & Field, New York.
 Steel, Adam, Cleveland.
 Wood, W. J., Chicago.

EVAPORATING AND DISTILLING APPARATUS.
 Reilly Repair & Supply Co., James, New York.

FANS FOR VENTILATION, EXHAUST, ETC.
 Sturtevant, B. F. Co., Boston.

FEED WATER PURIFIERS AND HEATERS.
 Learmonth, Robert, Buffalo.
 Reilly Repair & Supply Co., James, New York.
 Ross Valve Co., Troy, N. Y.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
 General Electric Co., Schenectady, N. Y.
 Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

FORGES.

Sturtevant, B. F. Co., Boston.

FORGINGS FOR CRANK, PROPELLER OR
THRUST SHAFTS, ETC.
 Cleveland City Forge & Iron Co., Cleveland.
 Fore River Ship & Engine Co., Quincy, Mass.
 Macbeth Iron Co., Cleveland.

FLUE WELDING.

Fitz's, S. & Sons, Cleveland.

FURNACES FOR BOILERS.

Continental Iron Works, New York.

FUELING COMPANIES AND COAL DEALERS.

Hanna, M. A. & Co., Cleveland.
 Ironville's Dock & Coal Co., Toledo, O.
 Pickands, Mather & Co., Cleveland.
 Pittsburgh Coal Co., Cleveland.
 Rochester & Pittsburgh Coal & Iron Co., Buffalo.
 Smith, Stanley B. & Co., Detroit.
 Smith Coal & Dock Co., Stanley B., Toledo, O.
 Youghiogheny & Lehigh Valley Coal Co., Chicago.

GALLEY UTENSILS.

Siegel Cooper Co., New York.

GASKETS, RUBBER.

New York Belting & Packing Co., New York.

GAS BUOYS.

Safety Car Heating & Lighting Co., New York.

GAS AND GASOLINE ENGINES.

Chase Machine Co., Cleveland.

GAUGES, STEAM AND VACUUM.

American Steam Gauge Co., Boston.
 Ashton Valve Co., Boston.
 Lunkenheimer Co., Cincinnati.

GRAPHITE.

Dixon Crucible Co., Joseph, Jersey City, N. J.

GROCERIES AND SUPPLIES.

Siegel Cooper Co., New York.

HATCH FASTENERS.

Mulholland, Capt. M., Cleveland.

HAMMERS, STEAM.

Chase Machine Co., Cleveland.

HEATING APPARATUS.

Sturtevant, B. F. Co., Boston.

HOISTS FOR CARGO, ETC.

American Ship Building Co., Cleveland.
 Brown Hoisting Machinery Co., (Inc.), Cleveland.
 Chase Machine Co., Cleveland.
 Elwell-Parker Electric Co., Cleveland.
 General Electric Co., New York.
 Hyde Windlass Co., Bath, Me.
 Lidgerwood Mfg. Co., New York.
 Marine Iron Co., Ray City.
 Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

HOLLOW STAYBOLT IRON.

Falls Hollow Staybolt Co., Cayaboga Falls, O.

HOSE, RUBBER.

New York Belting & Packing Co., New York.

HYDRAULIC DREDGES.

Great Lakes Engineering Works, Detroit.

HYDRAULIC TOOLS.

Watson-Stillman Co., The, New York.

ICE MACHINERY.

Roelker, H. B., New York.

INDICATORS FOR STEAM ENGINES.

American Steam Gauge Co., Boston.
 Ashton Valve Co., Boston.

INJECTORS.

American Injector Co., Detroit.
 Crane Co., Chicago.
 Jenkins Bros., New York.
 Lunkenheimer Co., Cincinnati.
 Peuberty Injector Co., Detroit, Mich.

INSURANCE, MARINE.

Brown & Co., Buffalo.
 Elphicks, C. W. & Co., Chicago.
 Fleming & Co., P. H., Chicago.
 Hawgood & Co., W. A., Cleveland.
 Helm & Co., D. T., Duluth.
 Hutchinson & Co., Cleveland.
 McCarthy, T. B., Montreal.
 McCurdy, Geo. L., Chicago.
 Mitchell & Co., Cleveland.
 Moffat & Son, San Francisco.
 Peck, Chas. E. & W. F., New York and Chicago.
 Prindiville & Co., Chicago.
 Richardson, W. O., Cleveland.
 Sullivan, D. & Co., Chicago.
 Weeks, F. H., New York.

IRON ORE AND PIG IRON.

Bourne-Fuller Co., Cleveland.
 Hanna, M. A. & Co., Cleveland.
 Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.

Marine Construction & D. D. Co.,
, Mariner's Harbor, S. I., N. Y.
 Truscott Boat Mfg. Co., St. Joseph, Mich.
 Warrington Iron Works, Chicago.
 Willard, Chas. P., Chicago.

LIFE FLOATS.

Carley Life Float Co., New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS.

Armstrong Cork Co., Pittsburgh.
 Carley Life Float Co., New York.
 Dreln, Thos. & Son, Wilmington, Del.
 Kahnweiler's Sons, D., New York.
 Lane & DeGroot, Long Island City, N. Y.
 Marine Construction & Dry Dock Co.,
, Mariner's Harbor, S. I., N. Y.
 Rippley Hardware Co., Grafton, Ill.

LIGHTS, SIDE AND SIGNAL.

Helvig, H. A. J., New York.
 Russell & Watson, Buffalo.

LOGS.

Bliss, John & Co., New York.
 Nicholson Ship Log Co., Cleveland.
 Walker & Sons, Thomas, Birmingham, Eng.
 Also Ship Chandlers.

LUBRICATING GRAPHITE.

Dixon Crucible Co., Joseph, Jersey City, N. J.

LUBRICATORS.

Crane Co., Chicago.
 Lunkenheimer Co., Cincinnati.

LUMBER.

Martin-Barriss Co., Cleveland.
 Moran Bros. Co., Seattle, Wash.
 Shurick, F. S., New York.

MACHINISTS.

Chase Machine Co., Cleveland.
 Lockwood Mfg. Co., East Boston, Mass.
 Macbeth Iron Co., Cleveland.
 Moners & Co., H., Milwaukee.
 Union Machine & Boiler Co., Cleveland.

MACHINE TOOLS (WOOD WORKING).

Atlantic Works, Inc., Philadelphia.

MARINE RAILWAYS, BUILDERS OF

Crandall & Son, H. I., East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.

Fogg, M. W., New York.
 Siegel Cooper Co., New York.

MECHANICAL DRAFT FOR BOILERS.

American Ship Building Co., Cleveland.
 Bloomsburg & Co., H., Baltimore, Md.
 Detroit Ship Building Co., Detroit.
 Sturtevant, B. F. Co., Boston.

METALLIC PACKING.

Hayden Mfg. Co., N. L., Columbus, O.
 Katzenstein, L. & Co., New York.
 U. S. Metallic Packing Co., Philadelphia.

METAL POLISH.

Bertram's Oil Polish Co., Boston.

MOTORS, GENERATORS—ELECTRIC.

Elwell-Parker Electric Co., Cleveland.
 General Electric Co., Schenectady, N. Y.
 Sturtevant, B. F. Co., Boston.
 Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

NAUTICAL INSTRUMENTS.

Bliss, John & Co., New York.
 Ritchie, E. S. & Sons, Brookline, Mass.

NAUTICAL SCHOOLS.

Chicago Nautical School, Chicago.
 Gould's Navigation School, Cleveland.
 McNevin's Navigation School, Detroit.
 McNevin's Navigation School, San Francisco.
 Seattle Nautical School, Seattle, Wash.

NAVAL ARCHITECTS.

Hynd, Alexander, Cleveland.
 Kidd, Joseph, Duluth, Minn.
 Matteson & Drake, Philadelphia.
 Mosher, Chas. D., New York.
 Nacey, James, Cleveland.
 Newman, R. L., New York.
 Sadler, Perkins & Field, New York.
 Steel, Adam, Cleveland.
 Wood, W. J., Chicago.

OAKUM.

DeGrauw, Aymar & Co., New York.
 Stratford Oakum Co., Jersey City, N. J.

OIL FOR PAINTING.

Sipe & Co., James B., Allegheny, Pa.

OILS AND LUBRICANTS.

Dixon Crucible Co., Joseph, Jersey City, N. J.
 Standard Oil Co., Cleveland.
 United States Graphite Co., Saginaw, Mich.

PACKING.

Crane Co., Chicago.
 Hayden Mfg. Co., N. L., Columbus, O.
 Jenkins Bros., New York.
 Katzenstein, L. & Co., New York.
 New York Belting & Packing Co., New York.
 United States Metallic Packing Co., Philadelphia.

PAINTS.

Baker, Howard H. & Co., Buffalo.
 Detroit Varnish Co., Detroit.
 Detroit White Lead Works, Detroit.
 New Jersey Zinc Co., New York.
 Sipe & Co., James B., Allegheny, Pa.
 United States Graphite Co., Saginaw, Mich.
 Upson-Walton Co., Cleveland.

PATENT ATTORNEYS.

Thurston & Bates, Cleveland.

PATTERN SHOP MACHINERY.

Atlantic Works, Inc., Philadelphia.

PILE DRIVING AND SUBMARINE WORK.

Buffalo Dredging Co., Buffalo.
 Chicago & Gr. Lakes Dredge & Dock Co., Chicago.
 Fitz-Simon & Connet Co., Chicago.
 Lake Erie Dredging Co., Buffalo.
 Smith Co., L. P. & J. A., Cleveland.
 Starke Dredge & Dock Co., C. H., Milwaukee.

PIPE-JOINT COMPOUND.

United States Graphite Co., Saginaw, Mich.

PIPE, WROUGHT IRON.

Bourne-Fuller Co., Cleveland.
 Crane Co., Chicago.
 Macbeth Iron Co., Cleveland.

PLANING MILL MACHINERY.

Atlantic Works, Inc., Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.

Bourne-Fuller Co., Cleveland.

PLUMBING, MARINE.

Reilly Repair & Supply Co., James, New York.
 Sands, Alfred B. & Son, New York.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

PNEUMATIC TOOLS.

Allen, John F.New York.

POLISH FOR METALS.

Bertram's Oil Polish Co.Boston

PRESSURE REGULATORS.

Kieley & MuellerNew York.
Ross Valve Co.Troy, N. Y.

PROPELLER WHEELS.

American Ship Building Co.Cleveland.
Atlantic WorksEast Boston, Mass.
Cramp, Wm. & SonsPhiladelphia.
Detroit Ship Building Co.Detroit.
Fore River Ship & Engine Co.Quincy, Mass.
Great Lakes Engineering WorksDetroit.
Hyde Windlass Co.Bath, Me.
Jenks Ship Building Co.Port Huron, Mich.
Lockwood Mfg. Co.East Boston, Mass.
Macbeth Iron Co.Cleveland.
Maryland Steel Co.Sparrow's Point, Md.
Milwaukee Dry Dock Co.Milwaukee.
Newport News Ship Building Co.Newport News, Va.
Phosphor Bronze Smelting Co., Ltd.Philadelphia.
Ridson Iron WorksSan Francisco.
Roelker, H. B.New York.
Sheriff's Mfg. Co.Milwaukee.
Superior Shipbuilding Co.Superior, Wis.
Thrupp & Sons Co., J. E.Trenton, N. J.
Trout, H. G.Buffalo.
United States Ship Building Co.New York.

PROJECTORS, ELECTRIC.

Elwell-Parker Electric Co.Cleveland.
General Electric Co.Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.Pittsburg, Pa.

PUMPS FOR VARIOUS PURPOSES.

Blake, Geo. F., Mfg. Co.New York.
Great Lakes Engineering WorksDetroit.
Kingsford Foundry & Machine Wks. Oswego, N. Y.
"Long-Arm" System Co.Cleveland.

PUNCHES, RIVETERS, SHEARS.

Allen, John F.New York

RANGES.

Russell & WatsonBuffalo.
Siegel Cooper Co.New York.

REFRIGERATING APPARATUS.

Roelker, H. B.New York.

REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes RegisterCleveland.
Record of American & Foreign Shipping.New York.

RIVETING MACHINES.

Allen, John F.New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.

Bourne-Fuller Co.Cleveland.

SAFETY VALVES.

American Steam Gauge Co.Boston.
Ashton Valve Co.Boston.
Crane Co.Chicago.
Hayden Mfg. Co., N. L.Columbus, O.
Lunkenhelmer Co.Cincinnati.

SAIL MAKERS.

Baker, Howard H. & Co.Buffalo.
Upson-Walton Co.Cleveland.
Wilson & SilsbyBoston.

SALVAGE COMPANIES.

See Wrecking Companies.

SCHOOLS, NAUTICAL.

Chicago Nautical SchoolChicago.
Go. Id's Navigation SchoolCleveland.
McNevin's Navigation SchoolDetroit.
McNevin's Navigation SchoolSan Francisco.
Seattle Nautical SchoolSeattle, Wash.

SEARCH LIGHTS.

Elwell-Parker Electric Co.Cleveland.
General Electric Co.Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.Pittsburg, Pa.

SHEARS.

See Punches, Rivets, and Shears.

SHIP AND BOILER PLATES AND SHAPES.

Bourne-Fuller Co.Cleveland.

SHIP BUILDERS.

American Ship Building Co.Cleveland.
Atlantic WorksEast Boston, Mass.
Buffalo Dry Dock Co.Buffalo.
Cramp, Wm. & SonsPhiladelphia.Craig Ship Building Co.Toledo, O.
Chicago Ship Building Co.Chicago.
Detroit Ship Building Co.Detroit.
Fore River Ship & Engine Co.Quincy, Mass.
Great Lakes Engineering WorksDetroit.
Jenks Ship Building Co.Port Huron, Mich.
Lockwood Mfg. Co.East Boston, Mass.
Manitowoc Dry Dock Co.Manitowoc, Wis.
Marine Construction & Dry Dock Co.
.....Mariner's Harbor, S. I., N. Y.
Maryland Steel Co.Sparrow's Point, Md.
Milwaukee Dry Dock Co.Milwaukee.
Newport News Ship Building Co.Newport News, Va.
Ridson Iron WorksSan Francisco.
Roach's Ship YardChester, Pa.
Shipowners Dry Dock Co.Chicago.
Smith & Son, AbramAlgonac, Mich.
United States Ship Building Co.New York.
Warrington Iron WorksChicago.
Willard, Chas. P. & Co.Chicago.

SHIP CHANDLERS.

Baker, Howard H. & Co.Buffalo.
Moran Bros. Co.Seattle, Wash.
Ridley Repair & Supply Co., JamesNew York.
Upson-Walton Co.Cleveland.

SHIP LANTERNS AND LAMPS.

Helvig, H. A. J.New York.
Russell & WatsonBuffalo.

SHIP TIMBER.

Martin-Bariss Co.Cleveland.
Moran Bros. Co.Seattle, Wash.
Shurick, F. S.New York.

SMOOTH-ON COMPOUND, FOR REPAIRS.

Smooth-On Mfg. Co.Jersey City, N. J.

SPARS—LARGE SIZES.

Moran Bros. Co.Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW, OR, SOLID.

Falls Hollow Staybolt Co.Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.

Elwell, Jas. W. & Co.New York.
Himes, SamuelNew York.
King, Rufus S.New York.
McCarthy, T. R.Montreal, Can.
Moffat & SonSan Francisco.
Newman, R. L.New York.
Weeks, F. H.New York.

STEAMSHIP LINES, PASS. AND FREIGHT.

American LineNew York.
Erie & Western Trans. Co.Buffalo.
International Mercantile Marine Co.Philadelphia.
Pere Marquette R. R. & S. S. Line.Milwaukee.
Red Star LineNew York.

STEEL CASTINGS.

Seaboard Steel Casting Co.Chester, Pa.
Macbeth Iron Co.Cleveland.

STEERING APPARATUS.

American Ship Building Co.Cleveland.
Chase Machine Co.Cleveland.
Dake Engine Co.Grand Haven, Mich.
Detroit Ship Building Co.Detroit.
Hyde Windlass Co.Bath, Me.
Jenks Ship Building Co.Port Huron, Mich.
Moulton Steering Engine Co.New York.
Sheriff's Mfg. Co.Milwaukee.

STOCKS, BONDS, SECURITIES.

Fahey & Co.Cleveland.

SUBMARINE DIVING APPARATUS.

Morse & Son, A. J.Boston.
Schrader's Son, A.New York.

SURVEYORS, MARINE.

Gaskin, EdwardBuffalo.
Hynd, AlexanderCleveland.
Matteson & DrakePhiladelphia.
Nace, JamesCleveland.
Newman, R. L.New York.
Steel, AdamCleveland.
Wood, W. J.Chicago.

TESTS OF MATERIALS.

Hunt, Robert W. & Co.Chicago.
Pittsburg Testing Laboratory Ltd.Pittsburg.

TILING, INTERLOCKING RUBBER.

New York Belting & Packing Co.New York.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Allen, John F.New York.
Watson-Stilman Co.New York.

TOOLS, WOOD WORKING.

Atlantic Works, Inc.Philadelphia.

TOWING MACHINES.

American Ship Windlass Co.Providence, R. I.
Chase Machine Co.Cleveland.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co.Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.Midland, Ont.

TRAPS, STEAM.

Kieley & MuellerNew York.
Lunkenhelmer Co.Cincinnati.
Sturtevant Co., B. F., Jamaica PlainBoston.

TRUCKS.

Boston & Lockport Block Co.Boston.

TUBING, SEAMLESS.

Shelby Steel Tube Co.Pittsburg, Pa.

VALVES, STEAM SPECIALTIES, ETC.

American Steam Gauge Co.Boston.
Ashton Valve Co.Boston.
Crane Co.Chicago.
Hayden Mfg. Co., N. L.Columbus, O.
Jenkins Bros.New York.
Kieley & MuellerNew York.
Lunkenhelmer Co.Cincinnati.
Moore & Co., H.Milwaukee.
Ross Valve Co.Troy, N. Y.

VALVES FOR WATER AND GAS.

Ross Valve Co.Troy, N. Y.

VARNISHES.

Detroit Varnish Co.Detroit.
Detroit White Lead WorksDetroit.
New Jersey Zinc Co.New York.
Also Ship Chandlers.

VESSEL AND FREIGHT AGENTS.

Boland, John J.Buffalo.
Brown & Co.Buffalo.
Elwell, Jas. W. & Co.New York.
Elphicke, C. W. & Co.Chicago.
Fleming & Co., P. H.Chicago.
Hall & RootBuffalo.
Helm & Co., D. T.Duluth.
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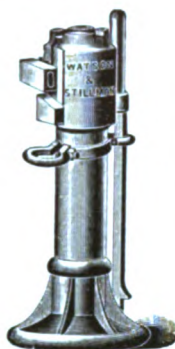
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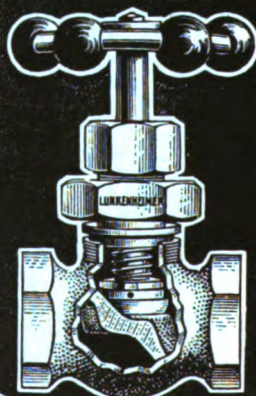
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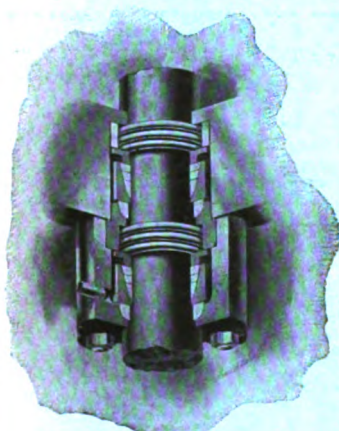
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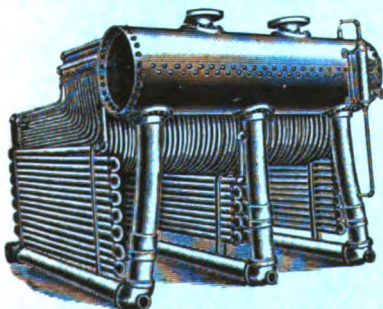
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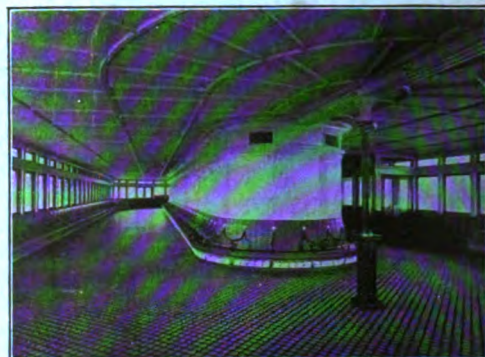
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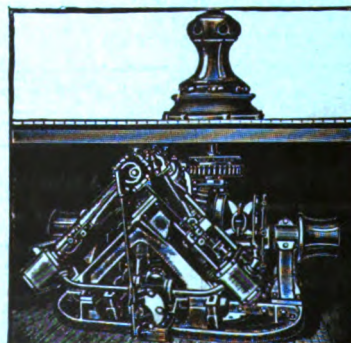
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